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BUSINESS REGULATION

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NATIONAL REGULATION

OF

INTER-STATE COMMERCE.

By C. C. BONNEY.

The lines of commerce are the lines of power.

CHICAGO:
THE CHICAGO LEGAL NEWS COMPANY.
1882.

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It is the right of the citizen freely to pursue his lawful business, subject to a just responsibility for all wrongs he may commit therein.

Enable the people to combine in the pursuit of sufficient remedies in adequate tribunals, and they will prove themselves stronger than monopolies and unlawful combinations.

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123

NATIONAL REGULATION
OF
INTER-STATE COMMERCE.

The trade of a country is the measure of its prosperity. Those who produce only what they must consume, exist. Those who also produce something which they can exchange with others for what they more desire, live. Commerce fills the space between mere existence and prosperous life.

In its largest and highest sense, commerce embraces all exchanges of product, intellectual as well as material. In common speech it signifies the exchange of merchandise, and is synonymous with trade, traffic, dealing, intercourse, interchange, communion and communication. [Webster.] In the law, commerce is defined to be "the exchange of commodities for commodities, and to consist in the various agreements which have for their object to facilitate the exchange of the products of the earth, or the industry of man,

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with an intent to realize a profit." [Bouvier.] The sense in which the word commerce is used in the national constitution, seems not only to include traffic, but also intercourse and navigation. [Story.]

Section eight of article one of the Constitution of the United States, declares that—

"The Congress shall have power,—

First: To lay and collect taxes, duties, imposts and excises; to pay the debts, and *provide for the general welfare of the United States;* but all duties, imposts and excises shall be uniform throughout the United States.

. . . . . .

Third: *To regulate commerce* with foreign nations, and *among the several States.*

. . . . . .

Ninth: To constitute tribunals inferior to the Supreme Court.

. . . . . .

Seventeenth: To make all laws which shall be necessary and proper for carrying into execution the foregoing powers, and all other powers vested by this constitution in the government of the United States, or in any department or officer thereof.

Section nine of the same article, provides among other things that—

Fourth: No capitation or other direct tax shall be

laid, unless in proportion to the census or enumeration hereinbefore directed to be taken.

Fifth: No tax or duty shall be laid on articles exported from any State. No preference shall be given by any regulation of commerce or revenue, to the ports of one State over those of another; nor shall vessels bound to or from one State be obliged to enter, clear or pay duties in another.

Section ten of the same article also provides, among other things, in the second clause thereof, that "no State shall, without the consent of the Congress, lay any imposts or duties on imports or exports, except what may be absolutely necessary for executing its inspection laws; and the net produce of all duties and imposts laid by any State on imports or exports, shall be for the use of the United States; and all such laws shall be subject to the revision and control of the Congress."

Section one of article three of the Constitution provides that the judicial power of the United States shall be vested in one Supreme Court, and in such inferior courts as the Congress may from time to time ordain and establish. And section two of the same article declares that the judicial power shall extend to all cases in law and equity, arising under this Constitution, the laws of the United States, and treaties made, or which shall be made under their authority;

. . . . . .
to controversies to which the United States shall be a party; and . . . . . .
. . . . . .
between citizens of different States.

As to their internal affairs, the several States of the Union are, in contemplation of law, foreign to each other. Their laws have no extra-territorial force, and their tribunals can exercise no authority beyond their boundary lines. [1 Bouvier's Inst. 83.]

A case in law or equity, is a suit or action in court; any legal process which a party institutes to obtain his demand, or by which he seeks his right, or supposed right. [Milligan's Case, 4 Wall. 112.]

"The government of the United States is emphatically and truly a government of the people. In form and substance it emanates from them. Its powers are granted by them, and are to be exercised directly on them, and for their benefit." [Opinion of the Supreme Court by Chief Justice Marshall, in McCulloch *v.* Maryland, 4 Wheaton, R. 403, *et seq.*]

The nature and extent of the power of Congress to regulate commerce among the several States have been discussed on numerous occasions, and may be deemed sufficiently expounded and settled for practical application.

The Supreme Court of the United States has re-

peatedly spoken in exposition of the constitutional provision. It is not necessary at this day to cite at any length the decisions made by that high tribunal. It will suffice to quote a few expressions indicative of the doctrines established by them.

1. "Commerce in its simplest signification, means an exchange of goods; but in the advancement of society, labor, transportation, intelligence, care, and the various mediums of exchange, become commodities, and enter into commerce; the subject, the vehicle, the agent and their various operations, become the objects of commercial regulation."

2. "Commerce consists . . . . . in transporting merchandise from the seller to the buyer, to gain the freight."

3. "The transportation of freights, or of the subjects of commerce, for the purpose of exchange or sale, is a constituent of commerce itself; and probably the transportation of articles of trade from one State to another, was the prominent idea in the minds of the framers of the constitutional provision. To regulate commerce, means to prescribe the rules by which commerce is to be governed."

4. "The power to regulate commerce among the States does not stop at their boundary lines, but may be exercised within the territorial jurisdiction of the

several States, or wherever the subject of regulation exists."

5. "Nor is the power to regulate commerce confined to acts done on the water, or in the necessary course of the navigation thereof. It extends to acts done on land, which interfere with, obstruct, or prevent the due exercise" of commercial rights.

6. "This power is as extensive upon land as upon water. The Constitution makes no distinction in that respect."

The transportation of property from one State into or through another, is within the constitutional power of regulation.

7. The design and object of the provision for congressional regulation, "was to establish a perfect equality among the several States as to commercial rights, and to prevent unjust and invidious distinctions, which local jealousies, or local and partial interests might be disposed to introduce and maintain."

8. The power to make all laws necessary and proper for carrying into effect the powers granted, confers on Congress a choice of means, "and all means which are appropriate, which are plainly adapted to the end, and which are not prohibited, are constitutional."

9. "The power of regulation and control attaches to inter-state traffic, not only where it has actually been carried across the dividing line of two States'

but from the moment it is taken in charge by the carrier as traffic, whether in goods or persons, and which is destined to cross State lines in its transit."

10. "Congress has power 'to regulate commerce with foreign nations and among the several States' (Con. U. S., Art I, § 8, par. 3), and to 'establish post offices and post roads.' Id. par. 7. The Constitution of the United States, and the laws made in pursuance thereof, are the supreme law of the land. Art. VI, par. 2. A law of Congress made in pursuance of the Constitution, suspends or overrides all State statutes with which it is in conflict."

"Since the case of Gibbons *v.* Ogden, 9 Wheat. 1, it has never been doubted that commercial intercourse is an element of commerce which comes within the regulating power of Congress. Post offices and post roads are established to facilitate the transmission of intelligence. Both commerce and the postal service are placed within the power of Congress, because, being national in their operations, they should be under the protecting care of the national government.

"The powers thus granted are not confined to the instrumentalities of commerce, or the postal service known or in use when the constitution was adopted, but they keep pace with the progress of the country, and adapt themselves to the new developments of time and circumstances. They extend from the horse

with its rider to the stage-coach; from the sailing vessel to the steam-boat; from the coach and the steam-boat to the railroad; and from the railroad to the telegraph, as these new agencies are successively brought into use to meet the demands of increasing population and wealth. They were intended for the government of the business to which they relate, at all times and under all circumstances. As they were entrusted to the general government for the good of the nation, it is not only the right, but the duty of Congress to see to it, that intercourse among the States and the transmission of intelligence, are not obstructed or unnecessarily encumbered by State legislation.

"The government of the United States, within the scope of its powers, operates upon every foot of territory under its jurisdiction. It legislates for the whole nation, and is not embarrassed by State lines. Its peculiar duty is to protect one part of the country from encroachments by another, upon the national rights which belong to all."

Such are the views of the highest judicial tribunal known to our form of government, of the nature and extent of the authority of congress to regulate commerce among the several states. The supreme court has also held, in substance, that the states have no authority over the subject of inter-state commerce, that

having been wholly given to the national government, but that until congress shall otherwise provide, the state legislatures may provide for merely local and incidental matters connected with inter-state traffic. So long as congress does not provide regulations for the transportation of persons and property among the states, it will be considered that the legislative power intends that the business shall be conducted in freedom from any such restriction.

It is obvious that all railroad charters granted by state authority, are necessarily subject to the paramount power of congressional regulation, in case the company shall in any degree engage in inter-state commerce.

Those who may desire to examine the subject for themselves, are referred to the following authorities and sources of information:

United States v. *Fisher*, 2 Cranch R. 358.
United States v. *Coombs*, 12 Peters R. 78.
McCulloch v. *Maryland*, 4 Wheaton R. 400.
Gibbons v. *Ogden*, 9 Wheaton R. 186.
The Passenger Cases, 7 Howard R. 392.
Geneses Chief v. *Fitzhugh*, 12 Howard R. 443.
Cooley v. *Port Wardens*, 12 Howard R. 299.
Veazie v. *Moor*, 14 Howard R. 56 '.
Gilman v. *Philadelphia*, 3 Wallace R. 713.
Crandall v. *Nevada*, 6 Wal'ace R. 35.
The Daniel Ball Case, 10 Wallace R. 557.
State Freight Tax Case, 15 Wallace R. 232.

Railroad Co. v. *Peniston*, 18 Wallace R. 5.
Railroad Co. v. *Richmond*, 19 Wallace R. 584.
Railroad Co. v. *Maryland*, 21 Wallace R. 456.
The Lottawanna Case, 21 Wallace R. 458.
Weston v. *Missouri*, 1 Otto R. 275.
Henderson v. *Mayor of N. Y.* 2 Otto R. 259.
The Granger Cases, 4 Otto R. 113–187.
Railroad Co. v. *Hudson*, 5 Otto R. 467.
Pensacola Telegraph Co. v. *W. U. Telegr. Co.* 6 Otto R. 1.
County of Mobile v. *Kimball*, 12 Otto R. 695.
Wagner's Essay, 7 Southern Law Review, 377.
Bantz' Essay, 12 Central Law Journal, 194.
Judge Redfield's Essay, 13 Am. Law Reg. U. S. 1.
Report Senate Com. Transportation, 79,240.

The Senate Special Committee was composed of William Windom, John Sherman, Roscoe Conkling, H. G. Davis of W. V., T. M. Norwood of Ga., J. W. Johnston of Va., John H. Mitchell of Oregon, and S. B. Conover of Fla.

The report of this committee was prepared by Mr. Windom in 1874. His conclusions, in which a majority of the committee concurred, include the following points: That congress may, in its discretion, prescribe the rules and regulations by which the instruments, vehicles, and agencies employed in transporting persons or commodities from one state into or through another shall be governed, whether such transportation be by land or by water.

That the power to regulate includes the power to

aid and facilitate, and congress may, in its discretion, improve or create channels of commerce, on land, or by water.

That, nevertheless, it is impracticable for congress, without more information than had then been obtained, to attempt to establish rates of fare and freight for transportation on railroads. But that railroad companies, and other common carriers, should be required to publish at all points, their tables of rates, with details of classification, rebates, etc., and should be prohibited from increasing such rates without reasonable notice.

That combinations of competing lines should be prohibited. That carriers should be required to receipt for goods by quantity, and to deliver the same accordingly. Also, that discriminations against water points should be prohibited.

The committee recommend the establishment of a "Bureau of Commerce," in one of the executive departments, to collect and report for the use of congress, information concerning the business of transportation, and the wants of commerce. They conclude that *cheap* transportation should be secured by national or state ownership or control of one or more lines of railway which, being unable to enter into combinations, will serve as regulators of other lines; and

by the improvement of the four chief water-lines of the country.

Judge Redfield, in his essay, declares that we can never have a successful railway system till it has been brought effectually under the control of congress. He says that congressional supervision may extend to all the appliances of transportation; to the men, and to the machinery; to the cars, the brakes, the switches, the running of trains, and whatever else may affect the conduct of the business. He insists that what we need is a national tariff of inter-state freights, with jurisdiction given to the national courts of all cases arising under the act, and he thinks that the form of redress should be to some extent provided.

With this brief review of the nature and extent of the power to regulate commerce among the states, we are prepared to consider the practical application of the power to the control of the every-day business of transportation. It is a fundamental principle of our system of government, that the citizen may act in freedom according to reason, being responsible for any abuse of his liberty. It is also a fundamental doctrine that the government should, as far as possible, abstain from intermeddling with the business pursuits of the people, and from engaging actively in any department of business. The province of the

government is to enact and execute laws, and laws are defined to be rules of conduct. The duty of the government is to prescribe the *rule* for the conduct of the citizen—not to take his place and conduct his business for him. There are judicial decisions which declare that the legislative authority may fix the price for which goods shall be transported by a common carrier; but it is not necessary to consider whether such decisions are sound in principle or not, for the obvious reason that the railroads in use in the inter-state commerce of the United States are so numerous, so extensive, and so differently circumstanced, that no legislative body could ever accomplish the gigantic task of enacting the necessary tariffs for freight and persons, with the proper adaptation to different seasons, and changing circumstances. But if it were possible, it would not be wise for congress to perform that work, for the reason that there is at hand a much more excellent way. The duties of common carriers have long been defined by well-established rules of law. What is needed is the proper provision for speedy, adequate and economical remedies for violating those duties.

A common carrier is one who holds himself out to the public as engaged in the business of carriage for hire. His province may be limited; he may run over a peculiar kind of highway; he may carry

either persons or property, or both, and his business may be confined to a particular kind of property, but he will still be a common carrier, if within his province he assumes to serve the public.

When a person invites the patronage of the public, and induces them to believe that they may rely upon him for the transportation of person or property, the law thereupon recognizes him as a common carrier, and imposes upon him the duty of *impartial service, for reasonable compensation*, and forbids all unjust discriminations and unfair dealing in the course of his business. At the same time the law imposes upon all who may seek the aid of the carrier, the corresponding duty of conforming to his reasonable regulations, and paying his reasonable charges.

Upon this liability of the carrier to the public, and of the public to the carrier, the law implies both a promise and duty of the carrier and of his patrons, to perform their respective obligations to each other. Hence there are two forms of remedy for wrongs suffered in the course of the business of common carriage: one for a breach of the duty, and the other for a violation of the promise.

As in every other department of human affairs, differences may arise between the parties. The carrier may offer insufficient accommodations, or charge an extortionate rate. The customer may demand the

transportation of nitro-glycerine in a passenger car, or insist on riding without payment of reasonable fare. In such a case the sovereign power generally refers the disputants to the judicial tribunals for a determination of their difference.

Among the rules which govern common carriers, as declared by the highest authorities, are the following:

1. "The term 'common carriers' includes the proprietors of stage-wagons, coaches, omnibuses, railways; also carters, expressmen, porters, ship-owners and the like, who are engaged in the business of transportation for hire."

2. "Common carriers of goods have for a long time been held liable for all damage and loss of goods during the carriage, from whatever cause, unless from an act of a public enemy; or from an act of God, which is held to mean an inevitable accident, against which no human foresight or sagacity could have provided."

3. "It has long been settled, says Judge Redfield, that the responsibility of common carriers results not simply from a contract, or from an implied understanding between the parties, but rather from the nature of the office or business; and that they may be sued in *tort* for a breach of duty, as well as in *assumpsit* for a failure to perform the undertaking of transportation."

4. "In general, both express companies and the rail-

road companies in connection with which they do business, are liable as common carriers."

5. "A common carrier does not warrant the safety of passengers, at all events; but he undertakes that he or his agent, if he acts by agent, shall possess competent skill; and that as far as human care and foresight can go, he will transport them safely. And in case of injury of a passenger, the carrier is bound to prove that his agent was a person of competent skill, good habits, and in every respect qualified, and suitably prepared for the business in which he was engaged; and that he acted on the occasion with reasonable skill, and with the utmost prudence and caution."

6. "A common carrier cannot charge what price he pleases, or receive or reject goods, or persons, at pleasure. He is entitled to a reasonable compensation, and must serve all alike."

7. "Charges for passengers and freight must be uniform; that is, the charges should be the same for all persons similarly situated; and for all freights of a like kind and quality, for a given service."

8. "A common carrier cannot reject a customer at pleasure, nor charge more than a reasonable compensation." And a common carrier cannot limit his liability by any *notice*, though he may do so by an express contract, if the customer chooses to make it.

9. Where several railroads, forming one line, have

common agents, and issue tickets and checks over the whole, the receiving company is liable for the entire route, and by many decisions, all or any of the carriers constituting the line may be held responsible. On this point the decisions of the courts are not uniform.

For these doctrines, and many others relating to the subject, those interested may refer, among other authorities, to the following:

2 Redfield on Railways.
Angell on Carriers.
Railway Law for Railway Men.
Stokes v. *Saltonstall*, 13 Peters R. 190.
Hollister v. *Nowlen*, 19 Wendell R. 234.
Railroad Co. v. *Parks*, 18 Illinois R. 464.
Door v. *Navigation Co.* 1 Kernan R. 485.
Railroad Co. v. *Copeland*, 24 Illinois R. 336.
Hunt v. *Railroad Co.* 4 Selden R. 37.

The duties of common carriers are plain enough, but the giant agencies of railway transportation cannot be controlled by the small proceedings devised for the stage-coach, the express-wagon and the canal-boat. There is an old doctrine that the law adapts itself to the changes of advancing civilization, and that the courts will give new and more adequate remedies as occasion may require. But this doctrine seems to have been forgotten, or to have lost its vitality. The legislative power must first act. It must declare the

duties of carriers, and provide remedies which shall be efficient, and within the reach of the people. No individual is powerful enough, or rich enough to carry on a successful conflict with a prosperous railroad company. He could as well arrest one of its engines by his physical strength. The individual citizen is powerless to assert his rights against the mammoth corporations by which the transportation business of the country is conducted.

But the people, through their law-making representatives, may provide for the appointment of agents to deal with those corporations, and require them to perform their duties, and obey the laws; and may establish tribunals to hear complaints, and give redress.

Under the power of congress to regulate commerce among the states, a statute may be passed, covering, among others, the following points:

It may declare the nationality of all lines participating in inter-state commerce.

It may subject them to the jurisdiction of the national tribunals.

It may provide special tribunals to hear and determine cases relating to inter-state commerce.

It may provide new or greater penalties for breach of contract, or violation of duty.

It may provide more adequate, efficient and economical methods of proceeding.

It may tacitly or expressly recognize the duties of common carriers as now defined by the courts, and it may also impose new obligations, such as the public good may require.

It may provide for public officers, whose duty it shall be to enforce the law before the proper tribunals, on their own motion, or at the instance of any person aggrieved, for the benefit of whom it may concern.

Statute-making is difficult work, but opinions on the subject of inter-state commerce will have little practical value, till they take the form of positive law, with specific provisions, capable of enforcement.

A draft of a bill for an act to regulate inter-state commerce is therefore appended. This bill assumes that sound doctrines of law for the government of vast interests during long periods of time, can best be discovered, tested and settled in the conflicts of the forum, where every aspect of a question should be subjected to analysis before determination. It aims to leave the carrier free to manage his business in his own way within the limits of reason and justice, but to subject him to severe penalties for extortion, oppression, and other wrong-doing; and it also endeavors to provide a practicable way in which persons aggrieved may combine in the pursuit of sub-

stantial remedies, before tribunals independent enough and powerful enough to award and enforce redress. It is believed that under such a law oppressive monopolies would be effectually restrained, and a wise jurisprudence of inter-state commerce be developed, under which the rights and interests of carriers and of people would be equally protected. To the development of such a jurisprudence, the creation of a National Court of Commerce would seem to be essential, unless it should be rendered unnecessary by an enlargement and reorganization of the national judiciary.

If all persons in a county or along the line of a railroad, could unite in a single suit to restrain, or seek compensation for any extortion or unjust discrimination, and could also recover the expenses of the proceedings, and a reasonable penalty, the railroad company would be very certain to take great pains to avoid such suits, and would, in most cases, prefer to make any just concession, rather than be involved in such contests. But there need not be any fear that such a law would breed needless litigation. It would be very difficult to effect a combination for the prosecution of a suit, without the existence of some serious wrong. It is true that severe penalties are provided for extortion and oppression, but they are not to be inflicted except after a fair hearing, and on due proof of guilt. The

bill contains no assumption by the legislative authority, of an impossible knowledge of the details of railway business. It assumes that self-interest, if no higher motive, will lead the carrier to act fairly; and it aims to provide the most ample facilities of complaint and redress for those who may be aggrieved. The theory of the bill is that if a wrong actually exists, its existence can be established by evidence, and a remedy be given by due course of law; and that the great questions of the rights and duties of inter-state commerce now agitating the country, would speedily be settled by judicial decisions, to which carrier and customer must alike submit.

Imperfect as the following bill may be, it is a beginning of a work second to no other in commercial importance; a work which appeals to the statesmen of this country for their immediate and earnest attention; a work which the people will not much longer suffer to be neglected.

National citizenship, and a national currency, must soon be followed by a nationalization of commerce.

The commerce of this country can no more be restrained by the boundary lines of states, than by the boundary lines of counties. The states are practically incapable of dealing in any adequate way, with the great problems of inter-state transportation. A state is quite as likely to fall into the control of a gigantic

railroad combination, as it is to succeed in an endeavor to govern and restrain such a combination. The power that governs, must be stronger than the power that obeys. Hence the only authority which is adequate to the task of regulating and controlling the marvelous lines of commerce which span the continent, making all men neighbors, and multiplying a thousand-fold the prosperity, the power and the happiness of the country, is the authority of the whole people, acting through the appointed agencies as one august and irresistible ruler of the land—THE NATION.

A BILL FOR AN ACT TO REGULATE COMMERCE AMONG THE SEVERAL STATES.

SECTION 1. Means of conveyance made subject to the act.
SEC. 2. Liability of property and owners.
SEC. 3. Penalties for extortion, and other offenses.
SEC. 4. Tables of freights and fares to be posted. Penalty for unreasonable charges. Remedies by suit.
SEC. 5. Other laws suspended.
SEC. 6. Jurisdiction of Circuit and District Courts.
SEC. 7. National Court of Commerce established.
SEC. 8. Bills of lading, etc., suable in national or state courts.
SECS. 9, 10, 11, 12. Provisions for the prevention of strikes.

BE IT ENACTED BY THE SENATE AND HOUSE OF REPRESENTATIVES OF THE UNITED STATES, IN CONGRESS ASSEMBLED.

SECTION 1. That all means of conveyance, and the appurtenances thereof, by which any person or property shall be moved, for or in the course of the transportation thereof, from or through one or more of the several States, to any other State, or to any foreign country; and the owners and operators of such means of conveyance, shall jointly and severally be deemed to be engaged in commerce among the several States, or with foreign nations, as the case may be, and shall be subject to the provisions of this act, excepting only persons or property received, carried and delivered wholly within the limits of a single State, and in separate means of conveyance, in which no person nor property not so received, carried and delivered, shall be conveyed.

SECTION 2. That all railroads, canals and other ways, which shall constitute the whole or any part or parts of any line of commerce among the several States; and all the property, fixtures and means of conveyance, in use thereon, shall be liable both jointly and severally, *in rem*, both at law and in equity, under this act, for the faithful performance and discharge of all duties of carriage, safe-keeping and delivery, imposed by this act, or by any other statute, or by the common law, relating to common carriers.

And all the owners and operators of any such line or part thereof, shall also be liable, both jointly and severally, with right of contribution, for the faithful performance and discharge of all the duties aforesaid.

SECTION 3. That if any such common carrier shall be guilty of extorting any unreasonable compensation for any such transportation; or shall be guilty of any unjust and oppressive discrimination therein; or shall willfully and unlawfully refuse to receive, or carry, or deliver, any person or property duly offered or received; or shall be guilty of any other such willful neglect or violation of duty, such common carrier shall be liable to pay and make good all loss or damage occasioned thereby, or in consequence thereof, together with all costs, counsel fees and other expenses, incurrrd in the recovery thereof; and in all cases where no reasonable excuse shall appear, the court shall give judgment for treble the total amount, as a penalty for the wrong done.

SECTION 4. That every such carrier shall, within the first five days of every month of April and November, post up in a conspicuous place at every station along the line thereof, a plain table of the rates of freight or fare to be charged till the next day for posting the same, with a specification of all discounts, rebates and allowances to be made under any circumstances, except only those of a casual or extraordinary character, which could not well be foreseen and provided for. If any such rate shall be unreasonable and oppressive, and shall be enforced after complaint made thereof, the carrier shall forfeit the whole amount thereof, to be recovered back with costs, counsel fees, expenses and penalty as aforesaid, either by action at law, or by bill in equity for an account. Different causes of action may be joined in the same suit, and any number of persons having similar grounds of complaint may join in one action or suit, and sever in the recovery or in a distribution of the proceeds thereof; and a few persons may sue as representatives of a class, for the equal benefit of themselves and all others having a common cause, who shall elect to come in and receive the benefit of the suit, and share in the conduct thereof; and any commissioner appointed under the authority of any State, may maintain such suits. The enforcement of any unjust or oppressive charge for the carriage of any person or property, may be enjoined so far as excessive; or the court may order the alleged excess to be paid to a receiver, to await the orders of the

court when the merits of the case shall have been heard and determined.

The court in which the suit shall be brought shall have ample power to decree and enforce restitution; and to adapt its process, proceedings, orders and decrees to the circumstances of the cases as they may arise, and to frame and establish new forms and precedents, as occasion may require; and may proceed either *in personam*, or *in rem*, or in both in the same suit. The fact that a remedy might be had at law, shall be no objection to the exercise of jurisdiction in equity, in any case under this act. And if, in any case brought in equity, there shall be, as to any question a constitutional right to a trial by jury, an issue shall be framed and tried accordingly, under the direction of the court, provided a demand for such trial shall have been filed at least ten days before the term at which the case shall stand for trial.

SECTION 5. That all other laws, rules and regulations which would in any manner interfere with the enforcement of the provisions of this act, are hereby suspended, and the enforcement thereof prohibited; and any attempt to enforce the same shall be deemed a contempt, and may be punished accordingly.

Provided, that in any case of doubt, application may be made to the proper court of the United States, for leave to enforce the regulation in question, and such leave, if granted, shall be a full protection.

SECTION 6. That the Circuit and District Courts of

the United States, respectively, shall have jurisdiction of all cases arising under this act; and whenever the pressure of business shall require, the presiding judge shall appoint one or more referees at law, or masters in chancery, to assist in the disposition of business before said courts. Said referees or masters may be appointed for a single case, or class of cases; and they shall have full power and authority to transact all interlocutory business, under the supervision of the court, but shall not enter final judgments or decrees; and they shall receive for the time actually spent in the business of the court, with the approval of the presiding judge thereof, a reasonable compensation to be fixed by said judge, and paid in like time and manner as other expenses of the court.

SECTION 7. That there is hereby established a National Court of Commerce of the United States, to be composed of a Chief Justice and four Associate Justices, who shall be appointed, hold office, and receive compensation, in the same manner as justices of the Supreme Court of the United States. Said court shall have an appellate jurisdiction, which shall be exclusive in the first instance, of all appeals and writs of error to review the final decision of any case arising under this act, made by any Circuit or District Court of the United States; and such jurisdiction shall be exercised in the same manner, and with the same effect, as heretofore by the Supreme Court. Appeals and writs of error may be prosecuted from said Court of Commerce to the Supreme Court, for the causes and in the manner hitherto allowed in cases in the Circuit Courts.

Said court of commerce shall hold an annual term at the city of Washington, commencing on the first Wednesday in the month of November, and may hold special terms at that place, or in any other place within the United States, which said court may appoint.

SECTION 8. All bills of lading, bills of exchange, and other contracts relating to, or arising in the course of the aforesaid commerce among the several States, shall be suable in the courts of the United States, as cases arising under the Constitution and laws thereof, or in the courts of the States, at the election of the plaintiff.

SECTION 9. The engineers or other operatives engaged in conducting any such business of inter-state commerce, or any number of them, or any representative or representatives thereof, may maintain suits under this act, for an increase of compensation, or the redress of any grievance; but shall not resort to a strike to secure such increase or redress, under the penalties hereinafter prescribed. Such engineers and operatives shall be regarded as engaged in a public service, and the court shall have power to fix their compensation at a reasonable amount, in case of a disagreement between them and the carrier.

SECTION 10. That all railroads, and other roads used in the business of commerce between or among the several States, or for the carrying of the mails of the United States, are hereby declared to be public highways of the United States, subject to the reasonable rules and regulations of the managers thereof for the proper transportation of persons and property thereon.

SECTION 11. If any person or persons shall willfully and unlawfully interfere with the business of commerce between or among the several States, by the obstruction of any such railway or other road, or by stopping, delaying, or interrupting the proper movement of any railway train or car, or any coach or other means by which commerce between or among the several States is or shall be carried on; or if two or more persons shall willfully and unlawfully conspire together to cause or procure any such stoppage, obstruction, delay or interruption, by or through any strike or combination of persons employed upon or in the business of any such railway, railway train, car, coach, or other means of carrying on such commerce, or by any other unlawful act, combination, or conspiracy whatsoever, the person or persons so offending shall respectively be deemed guilty of a high crime against the United States, and upon conviction thereof, shall, respectively, be punished by fine not exceeding ten thousand dollars, and imprisonment at hard labor in the penitentiary, not exceeding ten years, or either, in the discretion of the court.

SECTION 12. The District and Circuit Courts of the United States shall have jurisdiction of all the criminal offenses described in this act; and it shall be the duty of the judges of said courts, respectively, to cause the proper grand juries to be summoned, impaneled, and charged to inquire of and concerning all such offenses within their respective districts. And it shall also be the

duty of all the executive and military officers and authorities of the United States, to render their assistance at the request and under the direction of said courts, or of the judges thereof, or other civil authorities, for the maintenance of the public peace and order, and the prompt suppression of all such strikes, combinations and offenses as the occasion may require.

[Read before the Chicago Philosophical Society, Dec. 17, 1881.]

Regulation of Media Ownership by the Federal Communications Commission

An Assessment

Stanley M. Besen, Leland L. Johnson

Rand

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PREFACE

To promote diversity in viewpoints available to the American public, and to prevent undue economic concentration, the Federal Communications Commission (FCC) has imposed a number of restrictions on the ownership of broadcasting stations and cable television systems. Because the broadcasting and cable industries have undergone rapid evolution since the time when these rules were adopted, the Commission has recently modified or abolished two of the rules and is considering changes in others.

In May 1984, the FCC abolished its regional concentration rule prohibiting common ownership of three commercial AM, FM, or television stations where any two stations are located within 100 miles of the third, and where the primary service areas of any of the stations overlap. In December 1984, the Commission modified its group ownership rule prohibiting a single entity from owning nationwide more than seven AM radio stations, and seven FM radio stations.

Other rules that have remained unchanged in recent years contain prohibitions against (a) a single entity owning two or more stations in the same service (AM, FM, or TV) in the same market, (b) the acquisition of stations in more than one service in the same market, and (c) the common ownership of cable television systems and either telephone companies or television stations in a market.

Produced under a grant from the John and Mary R. Markle Foundation, this report assesses the state of current knowledge about the likely effects of these rules and the consequences of the FCC's recent actions. An earlier Rand publication, *An Analysis of the Federal Communications Commission's Group Ownership Rules* (N-2097-MF), January 1984, was filed in the FCC dockets that reassessed the group ownership and regional concentration rules. The results of the present report should be of interest to government agencies, private industry, the academic community, and the public at large.

SUMMARY

The Federal Communications Commission has imposed a large number of regulations on the ownership of broadcast stations and cable systems to promote diversity of expression and to prevent the exercise of market power. Rules both restrict the ownership of stations in different markets and limit ownership combinations within markets. Among the combinations that are prohibited in the same market are those involving television stations and cable systems, telephone companies and cable systems, and broadcast stations in the same service (AM radio, FM radio, and television). Recently, however, the Commission has begun to reexamine of its rules. It has repealed its restriction on the common ownership of stations in the same region and has relaxed its rules that previously limited any entity to owning not more than seven stations in each broadcast service. Moreover, rules that restrict other combinations are also under reconsideration.

This study evaluates the available empirical evidence on the effects of media concentration to reach judgments about the desirability of modifying or eliminating existing FCC ownership regulations. Since much of this evidence is weak, and in some cases nonexistent, the examination is supplemented by economic analysis where necessary.

To analyze the effects of concentrated media ownership, a wide range of evidence is considered. Among the studies that are examined are those that relate ownership concentration to advertising rates, program prices, network compensation, network affiliation, profit margins, program ratings, station selling prices, and station programming practices.

The analysis of the effect of the ownership of stations in more than one market by a broadcast group reaches four basic conclusions. First, there is little evidence that substantial economies of scale result from combining stations into groups. Singly owned stations appear to be able to purchase efficiently the services that groups produce internally.

Second, there is no evidence that groups are able to exercise "leverage" in their dealings with networks, advertisers, and program suppliers. Although it has frequently been argued that group owned stations obtain more favorable terms than do singly owned stations, because they can threaten to withhold transactions with other members of the group, there is no evidence to support this view. Moreover, the theoretical case for the leverage hypothesis is weak.

Third, although the evidence is not strong, there appears to be little support for the proposition that group ownership facilitates collusive behavior. We conclude that group ownership is likely to facilitate collusion only where the same groups are present in a number of different communities that together form a single broadcast market and where that market is concentrated. One implication of this result is that the common ownership of broadcast stations in different markets is most likely to create market power when the stations are in the same geographic region.

Finally, it appears that there is no connection between group ownership and the diversity of viewing fare provided by a station, although there is only limited evidence on this point.

The analysis of the effects of group ownership implies that substantial relaxation of the rules restricting group ownership can probably be undertaken without great concern about an adverse impact, but that the FCC should carefully examine proposed broadcast station combinations to assure that they pose no anticompetitive threat. If, however, the Commission does not pursue such a policy, a rule limiting combinations in the same region—although not necessarily the now-abandoned regional concentration rule—should be considered.

Although there is less evidence about the effects of combinations of broadcast stations, or of broadcast stations and cable systems, within local markets than there is about the effects of group ownership, the following conclusions are, nonetheless, possible. First, there is little evidence that combinations of broadcast stations in the same market create market power. What evidence exists suggests that either there is no relationship or that combinations produce operating efficiencies. However, the tests of the hypothesis that ownership combinations create market power are far from definitive.

Second, there is little evidence that high concentration within a service in the same market results in anticompetitive behavior. Indeed, some evidence suggests that advertising rates are *higher* the *greater* is the number of a stations in a market. However, the theoretical case for the proposition that local market concentration can create market power is strong. Thus, the justification for retaining restrictions on combinations within broadcast markets is far greater than that for the group ownership rules. Nonetheless, where there are many competing stations in a local market, some combinations that are now prevented by FCC rules may be possible without great concern that the public will be harmed.

Third, although there is no evidence on the effects of combinations of broadcast stations and cable systems in the same market—because such combinations have long been prohibited—it seems unlikely that

substantial operating economies will result from combinations of these two services and that, except in markets already highly concentrated, these combinations are unlikely to create market power. We conclude that such combinations should be permitted except in markets where the number of broadcast stations is small.

For reasons similar to those regarding combinations involving broadcast stations within local markets, our analysis suggests that a prudent course would be to retain the ban on the common ownership of cable television systems and telephone companies in the same market. Although future technological developments may create a situation in which it is economically efficient for a single firm to provide all wire communications to the home, there now do not appear to be significant economies resulting from the joint provision of television and telephone services. At the same time, cable television systems and telephone companies are likely to compete in providing at least some services, although the provision of switched telephone service will continue to be a telephone company monopoly. For this reason, the retention of the ban on telephone-cable cross ownership appears warranted at this time. However, at some time in the future, if economies of scope between the two types of services become apparent, it may become appropriate to reconsider the restriction.

CONTENTS

PREFACE iii

SUMMARY v

Section

I. INTRODUCTION 1

II. GROUP OWNERSHIP 5
The Diversity of Services and the Economics of Group Ownership 5
Our Approach to This Study 8
Anticompetitive Behavior 9
Group Ownership and Ad Hoc Networks 23
Economic Efficiency 25
Diversity in Programming 28
Policy Implications 32
Options for Modifying the Group Ownership Rule 33

III. THE REGIONAL CONCENTRATION RULES 41

IV. RULES REGULATING LOCAL MARKET CONCENTRATION 46
The Duopoly and One-to-a-Market Rules 46
The Broadcast Television-Cable Cross Ownership Rule 54

V. TELEPHONE-CABLE TELEVISION CROSS OWNERSHIP 61
The Evolution of the Cable Industry 62
Key Aspects of the Ban 63
Economies of Scope and Economies of Scale 64
Should the Ban Be Lifted? 67
Basing Decisions on Local Market Conditions 73
Conclusions 76

I. INTRODUCTION

Only a few years after it came into being, the Federal Communications Commission began to regulate broadcast station ownership when it denied a second broadcast license in the same market to an existing station owner.[1] Subsequently, the Commission gradually erected a system of regulations that (a) prohibited anyone from owning more than seven AM radio stations, seven FM radio stations, and seven television stations, no more than five of which can be VHF stations, anywhere in the United States (the group ownership rules),[2] (b) limited the common ownership of broadcast stations in the same region (the regional concentration rules),[3] (c) limited anyone to owning only a single station in the same service (AM, FM, or television) in each market (the duopoly rules),[4] (d) prevented anyone from acquiring more than one station of any type in each market (the one-to-a-market rule),[5] (e) prohibited the ownership of both a television station and a cable television system in the same market (the broadcast-cable cross-ownership rule),[6] (f) prevented, except where grandfathered, the common ownership of a television station and a newspaper in the same market (the newspaper-television cross-ownership rule),[7] and (g) attempted to limit the number of television stations that a single entity could own in the major broadcast markets (the top 50 policy).[8] In addition to these rules, all of which involved the ownership of broadcast stations, the Commission also adopted rules that prevented the ownership of cable television systems by the three major broadcast networks[9] and

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[1]Genesee Radio Corp., 5 FCC 183 (1938).

[2]*Amendment of Multiple Ownership Rules*, 18 FCC 288 (1953); *Report and Order*, 43 FCC 2797 (1954).

[3]*Amendment of Multiple Ownership Rules (Regional Concentration)*, 63 FCC 2d 824 (1977).

[4]*Amendment of Multiple Ownership Rules*, 2 R.R. 2d 1588, 3 R.R. 2d 1554 (1964).

[5]*First Report and Order*, 22 FCC 2d 306 (1970). This rule has since been modified in a number of ways.

[6]*Diversification of Control of CATV Systems*, 22 FCC 2d 833 (1970); *Second Report and Order (Cross Ownership of CATV Systems)*, 23 FCC 2d 816 (1970), aff'd in *Iacopi v. FCC*, 451 F. 2d 1142 (9th Cir. 1971), on reconsideration, 26 R.R. 2d 739 (1973).

[7]*Multiple Ownership of Standard, FM and Television Broadcast Stations, Second Report and Order*, 50 FCC 2d 1046 (1975), as amended on reconsideration, 53 FCC 2d 589 (1975).

[8]*Report and Order*, in Docket No. 16068, 12 R.R. 2d 1501 (1968).

[9]*Diversification of Control of CATV Systems*, 22 FCC 2d 833 (1970); *Second Report and Order (Cross Ownership of CATV Systems)*, 23 FCC 2d 816 (1970), aff'd sub. nom. *Iacopi v. FCC*, 451 F. 2d 1142 (9th Cir. 1971), on reconsideration, 26 R.R. 2d 739 (1973).

prohibited, except in limited circumstances, the operation of a cable television system by the telephone company operating in the same market.[10]

Some of these rules have been abolished in recent years, and the Commission is reconsidering the appropriateness of others in light of the technological and market changes that have occured since their adoption. The top 50 policy was eliminated in 1979.[11] The regional concentration rule was recently repealed.[12] One network, CBS, has obtained a waiver that permits it to own a limited number of cable systems,[13] and the FCC is presently considering the total elimination of the network-cable cross-ownership rule.[14] Finally, the Commission recently attempted to relax its group ownership rules to permit the ownership of 12 stations in each service and to remove all restrictions on group ownership in 1990 if no further action is taken.[15] Under pressure from Congress, however, the change in the television ownership rules was deferred.[16] Given the FCC's ongoing reappraisal of its ownership rules, an independent examination of the effects of concentrated media ownership and of the Commission's rules is particularly appropriate at this time. Our approach is to examine critically the relevant quantitative analyses from past studies of the effects of media concentration to draw lessons about the need for, and effectiveness of, FCC rules limiting media ownership.[17] Where, as is often the case, the

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[10]*Applications of Telephone Companies for Section 214 Certificates for Channel Facilities Furnished to Affilated Community Antenna Television Systems*, 21 FCC 2d 307 (1970), reconsidered in part, 22 FCC 2d 746 (1970), aff'd sub. nom. *General Telephone Company of the Southwest v. United States*, 448 F. 2d 846 (5th Cir. 1971).

[11]*Amendment of Section 73.636(a) of the Commission's Rules (Multiple Ownership of Television Stations)*, 75 FCC 2d 585 (1979), recon. denied, 82 FCC 2d 329 (1980), aff'd sub. nom. *National Association for the Advancement of Colored People v. FCC*, 682 F. 2d 993 (D.C. Cir. 1982).

[12]Repeal of the "Regional Concentration of Control" Provisions of the Commission's Multiple Ownership Rules, 49 *Fed. Reg.* 19678 (1984).

[13]CBS, Inc., 87 FCC 2d 587 (1981).

[14]*Notice of Proposed Rulemaking*, in CT Docket No. 82-434, 91 FCC 2d 76 (1982).

[15]*Report and Order in the Matter of Amendment of Section 73.3555* (formerly sections 73.35, 73.240, and 73.636) *of the Commission's Rules Relating to Multiple Ownership of AM, FM and Television Broadcasting Stations* (Gen. Docket 83-1009), adopted July 26, 1984, released August 3, 1984.

[16]"FCC strikes the flag on TV ownership rules," *Broadcasting*, August 13, 1984, at 35, 38-39. While this study was in press, the Commission reaffirmed its decision to permit group ownership of up to 12 television stations, as long as their combined audience share is less than 25 percent of the nation's households. Special rules were established for UHF and minority-owned stations. *Wall Street Journal*, December 20, 1984, p. 4.

[17]The effect of newspaper-broadcasting cross ownership was previously analyzed in W. S. Baer, H. Geller, J. N. Grundfest, and K. B. Possner, *Concentration of Mass Media Ownership: Assessing the State of Current Knowledge*, The Rand Corporation, R-1584-

available evidence does not support definitive judgments, we undertake additional economic analyses to shed further light on these issues. However, original quantitative work is beyond the scope of this report.

Section II, the largest portion of the study, is devoted to the evidence on the effects of group ownership. The greater length of this chapter than of others does not imply any greater importance of the group ownership issue over other issues, but rather reflects the fact that most of the available empirical evidence on the effects of media concentration is in this area. The section concludes with an analysis of alternatives to the FCC's previous group ownership rules.

Section III examines the effects of concentrated regional ownership. Since there is virtually no empirical evidence on the effect of such concentration, we use economic analysis to examine the likely effects of the common ownership of television stations that are in geographic proximity to one another but not in the same local market. We also examine the rationale provided by the FCC in its recent order eliminating the regional concentration rule.

Section IV focuses on the effect of broadcast station ownership within a single market. Evidence is drawn from cases in which combinations that would otherwise have been prohibited have been grandfathered, as well as from comparisons of behavior in markets where ownership is concentrated with those where it is not. The section also examines the effect of the FCC rule banning the common ownership of cable television systems and broadcast stations in the same market. Section V examines cable television-telephone cross ownership. Since there is no empirical evidence with which to assess FCC rules in these areas, we apply economic analysis to assess their likely effects.

This report reaches three broad conclusions. First, although the available empirical evidence is not strong, it suggests that concentrated ownership leads neither to large operating efficiencies nor to anticompetitive behavior. In short, existing studies provide neither a basis for retention of the Commission's ownership rules nor one for their repeal.

Second, economic analysis suggests that there is little or no basis for the FCC's group ownership rules, some possible support for rules limiting regional concentration, and the strongest case for rules that limit cross ownership within narrow geographic areas. However, where local markets are unconcentrated, combinations that are presently prohibited by FCC rules can probably be permitted without fear that anticompetitive behavior will result. A corollary is that the

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NSF, September 1974, and is not considered here. Moreover, we do not examine rules such as the network-cable cross-ownership rule that apply only to the broadcast networks.

Commission should be most concerned about media combinations in markets where the number of outlets is small. For this reason, continuing the ban on telephone-cable cross ownership may be appropriate, if these entities are alone in providing certain services.

Finally, present FCC rules, and many of the proposals for their repeal or modification, are often deficient because their arbitrary nature fails to take into account actual competitive conditions in the markets where combinations are being proposed. As a result, the Commission may permit combinations that, on competitive grounds, should be denied, and may forbid others that pose little or no threat to competition. For this reason, we recommend that the Commission's ownership rules be replaced by a case-by-case approach to media combinations. Proposed combinations would be subject to scrutiny by the FCC, which would permit or deny them based on whether, given the extent of market concentration, they would increase the likelihood of anticompetitive behavior.

II. GROUP OWNERSHIP

In enacting the group ownership rules to limit national ownership of broadcasting stations, the goals of the Federal Communications Commission were "to maximize diversification of program and service viewpoints as well as to prevent any undue economic concentration contrary to the public interest."[1] However, the FCC has recently relaxed its restrictions to permit the ownership of 12 AM and 12 FM stations, proposed to do the same for television, and indicated that it would eliminate these restrictions altogether in 1990 unless further action is taken.[2] The Commission reconsidered its group ownership rules because the basis for the limit of seven stations in each service has never been clear, nor did the rules take into account either the importance of the stations held or the extent of competition in the areas in which they operate. Moreover, the radio and television broadcast industry has changed greatly since the rules were adopted in their present form in 1954.[3] Among the options considered were the elimination of the rules, changing the numerical limits, or limiting not simply the number of stations that may be owned but rather the number of viewers who can be reached by a single owner's stations.

THE DIVERSITY OF SERVICES AND THE ECONOMICS OF GROUP OWNERSHIP

Current restrictions on group ownership primarily reflect the desire to promote diversity of information sources to the American public. As it explained in its *Notice of Proposed Rulemaking*, "The Commission's principal concern in implementation of its policy of diversification of ownership has not been the enhancement of economic competition but, rather, the advancement of diversity in sources of information in order

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[1]FCC, *Notice of Proposed Rulemaking*, Gen. Docket No. 83-1009, October 20, 1983, at 32.

[2]FCC, *Report and Order*, adopted July 26, 1984, released August 3, 1984, announced the modification of the rules to permit the ownership of up to 12 stations in each service. FCC, *Order*, adopted and released August 9, 1984, announced that the Commission would not implement its decision for television until 60 days after reconsideration or until April 1, 1985, whichever is later.

[3]*Report and Order*, at para. 34-35.

to further First Amendment values."[4] Implicit in this statement is the fear that group owners tend to impose on their stations common points of view and sources of programming that reduce diversity below the level afforded by singly owned stations. Concerns have also been expressed that group ownership tends to increase the selling prices of stations, making it more difficult for them to be acquired by minority groups and others who would add to the diversity of viewpoints.

Thus, for example, Coffey[5] argues that

> The goal of diversity rests on the theory that separate coverage of social and political events will lead to more varied presentations, thereby facilitating greater accuracy, fairness, thoroughness and balance of the media. It is based on noneconomic considerations. It is a deeply ingrained legal belief that ownership diversity tends to enhance this country's democratic ideals by limiting the importance which any set of sources plays in shaping opinions and attitudes.

A factor both conflicting with and complementing the goal of diversity, however, is the effect of group ownership on the economic efficiency with which stations operate. Economies may well result when broadcast stations are joined together into groups. For this reason, the Commission has argued that: "The multiple ownership of broadcast stations does play an important role in our nationwide broadcast system."[6] Groups may be able to provide services to their stations, including the production and acquisition of programs and the selling of advertising, at a lower cost than the combined costs of each of the stations operated independently. When current limitations on group size prevent these economies from being fully realized, i.e., if groups must operate below minimum efficient scale, station operating costs are higher than necessary.[7] As a result, a conflict may exist between the goals of maximizing diversity and maximizing the efficiency of the broadcasting system. If the Commission relaxes its rules and the economies of group ownership are important, singly owned stations will be placed at an additional competitive disadvantage creating incentives for them to be acquired by station groups.[8]

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[4]*Notice of Proposed Rulemaking*, at 41.

[5]A. Coffey, "The 'Top 50 Market Policy': Fifteen Years of Non-Policy," 31 *Federal Communications L.J.* 303 (1979), at 319.

[6]43 FCC 2797, at 2801 (1954).

[7]Whether singly owned stations have higher costs depends importantly on whether their ability to purchase services from networks, program syndicators, and spot advertising representatives is an effective substitute for the services provided by groups to their members.

[8]As we will see below, it is also argued that groups may be able to disadvantage their singly owned rivals even if groups are *not* more efficient.

At the same time, a complementary relationship may also exist between the two goals. The economies afforded by group ownership may permit better or different programs that also contribute to diversity. As the Commission recognizes: "There may be greater diversity of views in the programming made available by strong group owners than in the repetitive fare which may otherwise be available."[9] Moreover, the number of economically viable stations may be reduced if efficiencies in station operation achieved through group ownership are not fully exploited.

A major issue, then, is the extent to which group ownership does, in fact, generate operating economies. If no economic advantages are conferred, it may be possible to increase the diversity of views without economic loss simply by restricting any entity to owning a single station. However, if the economic advantages of group ownership are large, the Commission must consider carefully the gains that might be achieved by liberalizing or eliminating its ownership restrictions and the effect of these gains on program diversity.

Finally, the FCC has been concerned with the issue of market power in the hands of groups. As it stated when the group ownership rules were amended in 1953:

> One of the basic underlying considerations in the enactment of the Communications Act was the desire to effectuate the policy against the monopolization of broadcast facilities and the preservation of our broadcasting system on a free competitive basis. . . . This Commission has consistently adhered to the principle of "diversification" in order to implement the Congressional policy against monopoly and in order to preserve competition.[10]

Addressing this concern raises questions about whether groups, either acting individually or in concert, engage in anticompetitive behavior.

Some have argued that group owners compete unfairly with singly owned stations by using their greater economic power in bargaining with advertisers, syndicated program suppliers, and networks. For example, Coffey has argued that

> Independent stations compete with each other to purchase "off-network" syndicated programs. . . . Those independents which are part of a group have a distinct competitive advantage over single-owned independent stations in the same market by virtue of their buying power. The leverage may be illustrated by the hypothetical top fifty group owner with independent stations in markets one, two and eight. Such an owner is in a position to tie his purchase of a

[9] *Notice of Proposed Rulemaking*, at 46–47.

[10] *Amendment of Multiple Ownership Rules*, 9 R.R. 1563, at 1568 (1953).

> syndicator's programs in markets one and two to the supplier's promise to sell the same program to him in the less lucrative market eight. A single station owned independent station in market eight is thereby at a competitive disadvantage.[11]

Thus, it is contended, group owners may "leverage" their control of stations in some markets into obtaining more favorable terms in others.

In addition to the possibility that the behavior of individual groups may be anticompetitive, there is also the danger that group ownership may facilitate collusion among stations and further enhance their market power. If groups expand in size, the number of separate station owners within the relevant markets for advertising and programming might fall sufficiently to facilitate collusive behavior. Whether the threat of collusion would intensify if the group ownership rules were liberalized or eliminated is thus clearly relevant to the current debate.

OUR APPROACH TO THIS STUDY

First, we assess the empirical evidence from past studies about the effects of group ownership on competitive behavior. This task involves examining reported differences between group owned and singly owned stations with respect to advertising rates, program prices, network compensation, network affiliation, and profit margins. We conclude that no evidence exists to support the view that groups have engaged in anticompetitive activity. However, only a limited amount of evidence is available and, in some cases, it is in a form that does not permit the effects of economies of group ownership to be disentangled from those of anticompetitive behavior.

In light of the limited value of this evidence, we analyze the conditions under which groups, acting either individually or in collusion with others, would likely behave anticompetitively. We conclude that such behavior by individual groups is quite unlikely. A less remote possibility is collusion among groups, which might arise if certain patterns of group ownership were to emerge.

We also conclude that the economies resulting from group ownership are not large. This conclusion follows from an examination of studies of the effect of group ownership on program ratings, profit margins, advertising rates, and station program practices, and of the growth of group ownership.

Finally, we examine the implications of group ownership for program diversity. Although this evidence is not strong, it suggests that

[11]Coffey, op. cit., at 319.

there is little or no relationship between programming performance and the existence of station groups.

We conclude this section by discussing options available to the Commission and show that either simply raising the limit on the number of stations that may be owned, or substituting an ownership limitation based on the size of the audience served, would fail to cope with the possible dangers of collusive behavior. We also discuss a possibly better option—lifting the blanket restrictions on the number of stations owned and instead evaluating proposed station acquisitions or applications for new licenses by existing station owners case by case under well-defined criteria.

ANTICOMPETITIVE BEHAVIOR

Advertising Rates

Group ownership can affect advertising rates if groups are more efficient than are singly owned stations or if group ownership promotes anticompetitive behavior. Consequently, it is important to identify the differences in behavior of group owned and singly owned stations to permit these effects to be isolated from one another. To do so we must consider five cases: (1) group owned stations operate more efficiently than do singly owned stations but do not engage in anticompetitive activities; (2) group owned stations are more efficient, and engage in collusion; (3) group owned stations are no more efficient and engage in collusion; (4) group owned stations are more efficient and exert leverage in their dealings with others; and (5) group owned stations are no more efficient and exert such leverage.

Case 1: Greater Efficiency Without Anticompetitive Behavior. In Case 1, we would expect markets containing only group owned stations to have lower per-viewer advertising rates (everything else held constant) than markets with only singly owned stations or markets with a mixture of the two types of stations. In a mixed market, for example, advertising rates presumably would be determined by the higher costs of the singly owned stations. Advertisers, concerned with cost per viewer reached, would be indifferent as to which stations they use.[12] Hence, rates per viewer for all stations would tend to be identical.

[12]However, if advertisers are willing to pay higher rates per viewer to stations with larger audiences, group owned stations will have higher rates if their greater efficiency produces larger audiences. It is widely believed that some advertisers are willing to pay for "reach," to avoid repetitive exposure of their advertisements to the same viewers.

These rates would be just high enough to cover the costs of the singly owned stations (which are the "marginal" stations), whereas group owners would enjoy higher profit margins because of their lower costs. Hence, the rates in mixed markets would be above those in group-only markets where the marginal stations have lower costs. Moreover, rates in mixed markets would be lower, the larger the proportion of a market served by the more efficient group owned stations. Rates would be highest in markets without any group owned stations.

Case 2: Greater Efficiency and Collusion. If group owned stations are able to collude, the extent to which they are able to raise advertising rates depends on the competition they face from singly owned stations.[13] At the same time, if group ownership produces operating efficiencies, advertising rates will tend to be reduced by the presence of group owned stations in a market. As a result, comparisons of advertising rates among markets will fail to distinguish between the effects of efficiency and those of collusion. The greater efficiency of groups will drive down rates, whereas collusion would push these rates in the opposite direction. Conceivably, rates could be similar across markets with the downward pressure from group efficiencies being offset by the upward pressures of collusion among groups.

Case 3: No Greater Efficiency and Collusion. Without the offsetting effects of group efficiencies, group ownership would raise advertising rates in group-only and mixed markets if groups collude more effectively than singly owned stations. Thus, one can identify and measure the efficiencies produced by group ownership only if no collusion exists among groups, since otherwise advertising rates will reflect the combined effect of both factors.

Case 4: Greater Efficiency and Leverage. In cases 1–3, advertising rates of group owned stations were the same as those of other stations in a mixed market, with any differences in costs being reflected in higher profit margins of group owned stations. If groups are able to raise advertising rates, an "umbrella" is placed over their less efficient singly owned rivals. However, if groups are able to use leverage across the markets in which they operate in bargaining with advertisers, we would expect the advertising rates of their stations to be higher than those of other stations in the same markets. To examine this possibility, one would compare the rates of group owned and singly owned sta-

[13]The conditions under which group owned stations are more likely to collude than singly owned stations are discussed below.

tions *within* markets—in contrast to the previous cases where one would be concerned with comparisons *among* markets.[14]

Case 5: No Greater Efficiency and Leverage. Again leverage would be manifested in higher advertising rates for group owned stations, but their profits would be lower than those in case 4 because there is no efficiency gain from group ownership.

What Does the Evidence Show?

With respect to the issue of collusion, three studies are notable. One, by Peterman,[15] involves the estimation of regression equations in which the dependent variable is the discounted 20-second national spot rate for prime time. Peterman seeks to determine whether group ownership affects advertising rates by constructing a sample of 97 TV markets containing those with three stations plus all other markets in which three stations obtained more than 90 percent of the audience, i.e., very small and very large markets were excluded. For each of the 97 markets, he derives the average number of homes reached per dollar expenditure per 20-second advertisement. After controlling for homes reached and market income, and estimating separate regressions for the 54 small markets and the 43 large markets in the sample, Peterman finds no evidence of collusion. Neither the percentage nor the number of group owned stations in the market is significant in explaining advertising rates.

Although Peterman's analysis is the most useful we have seen in addressing the question of collusion, his results are subject to three caveats. First, he distinguishes markets only by the *percentage* or *number* of group owned stations in each. Although this approximates the tests discussed above, differentiating markets by the relative market shares of group owned and singly owned stations would better measure their competitive positions.

Second, Peterman leaves untested the question of the proper definition of the relevant market, implicitly assuming that the market is local.[16] However, Peterman's tests may fail to detect collusion if the relevant markets for advertising are larger than the city or metropolitan markets in his sample.

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[14]If, however, group owned stations generate larger audiences than singly owned stations and advertisers are willing to pay more per viewer for larger audiences, group owned stations can have higher rates even if they do not exert leverage.

[15]J. L. Peterman, "Concentration of Control and the Price of Television Time," 61 *American Economic Review* 74 (Papers and Proceedings) (1971).

[16]This assumption can be inferred, since his elimination of very large and very small markets and his measures of the extent of group ownership are based on the number of stations and group owned stations in a particular city or metropolitan area.

To demonstrate, consider four cities, each containing group owners drawn from the set A, B, C, D, E, F, G, H, I. These owners are distributed among the four cities as follows:

City:	1	2	3	4
Groups	A,B,C	A,B,C	D,E,F	G,H,I

Suppose that cities 1 and 2 form one market for selling advertising, whereas cities 3 and 4 form another advertising market. Looking at each of the cities separately, one would conclude that groups are equally represented with three stations in each city. However, the market consisting of 1 and 2 contains only three separate owners but the market containing 3 and 4 contains six. Thus, the advertising market containing 1 and 2 is more concentrated.

Even if these differences in ownership produce higher rates in the advertising market containing 1 and 2, no measured correlation will appear between group ownership and advertising rates, since all of the stations are group owned. Thus, Peterman's tests would not be able to explain why rates are higher in cities 1 and 2.[17]

Third, as we point out above, rates can be similar across markets even if group owned stations collude, if group ownership leads to greater operating efficiency. Only if group owned stations are no more efficient than their singly owned rivals will a comparison of advertising rates reflect solely the effects of collusion.

A second study, by Fournier and Martin,[18] tests whether the presence of a network owned station in a market affects spot advertising rates. Their analysis has the advantage of being based on data from actual advertising contracts rather than on rate cards or on synthetic prices constructed from advertising revenue data that Peterman and others rely on. They relate these data to the audience exposed to the advertisement, sometimes disaggregated into demographic categories, as well as to various measures of the degree of concentration among stations in the locality served by the station in question.

Fournier and Martin find that the presence of a network owned station in the market does not affect advertising rates, suggesting that the networks do not collude. This finding is notable because the major

[17]We are not arguing that advertising markets are necessarily larger than those Peterman uses. But we emphasize that if advertising markets are larger than his local markets, collusion could exist that Peterman would fail to detect.

[18]G. M. Fournier and D. L. Martin, "Does Government-Restricted Entry Produce Market Power?: New Evidence from the Market for Television Advertising," 14 *Bell J. of Econ.* 44 (1983).

networks with their owned stations face each other in several major metropolitan markets such as New York, Chicago, and Los Angeles. If these cities together constitute a sufficiently distinct advertising market to permit broadcasters there to collectively exercise market power against advertisers, the networks would be in a particularly good position to exploit this opportunity. If they do so, rates in markets with network owned stations would be higher (again with everything else held constant) than the rates elsewhere.[19]

Fournier and Martin also conclude that advertising rates "appear to be unrelated to measures associated with market power."[20] Thus, for example, they find no statistically significant differences in rates between markets with few stations and those with many. However, they do not replicate Peterman's approach of distinguishing among markets by the number and percentage of group owned stations. Thus, their failure to find a significant relationship between market concentration and advertising rates does not indicate whether collusion is facilitated by group ownership.

Finally, Fournier and Martin, like Peterman, implicitly define advertising markets as encompassing a city or metropolitan area. Thus, if advertising markets are larger than conventionally defined television markets, their tests may fail to detect evidence of collusion, even if it exists.

A third study, by Wildman, also bears on the question of the effect of network station ownership on advertising rates.[21] After controlling for a number of other factors, Wildman tests whether a station that is network owned or competes with a network owned station has higher spot advertising rates. He finds that network owned stations have significantly higher rates, other things equal, but that stations with which they compete have rates that are not significantly different from those of other affiliates.

However, Wildman does not attribute the higher rates of network owned stations to collusion among the networks. Instead, he hypothesizes that, since network owned stations will "clear" (carry) a larger proportion of the network lineup than other affiliates, other things equal, there will be fewer spot advertisements to be sold where such stations are in the market. The result will be higher spot rates.

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[19]Note that this comparison is analogous to those in cases 2 and 3 discussed earlier. "Mixed" markets convert here to markets with network owned stations, and markets with "only singly owned" stations convert to markets without network owned stations.

[20]Op. cit., at 44.

[21]S. Wildman, "Vertical Integration in Broadcasting: A Study of Network Owned and Operated Stations," *Proceedings of the Symposium on Media Concentration, Volume I,* Federal Trade Commission, Washington, D.C., 1978.

In Wildman's view, therefore, higher rates result not from coordinated behavior among the networks but from differences between the behavior of network owned stations and affiliates. He does not attempt to explain why other stations in the market fail to benefit from the restricted supply of spots on network owned stations.[22]

A larger number of studies address the issue of leveraging—relevant to cases 4 and 5 above. The earliest, by Cherington et al., involves comparisons of advertising rates between group owned and single owner stations.[23] The authors conclude that "there was no difference in the overall averages [of prime 20-second spot rates] for the group-owned stations vs. the single-owner stations ($3.27 and $3.28, respectively, in 1965). . . . For market group 101–150, group-owned station averages were slightly, but not significantly, higher, while for the market group with the smallest audiences the single-owner stations showed higher cost-per-thousand figures."[24]

The authors also examine rates based on network gross class A hourly time charges for the years 1960 to 1965. For all markets taken together, group owned stations charge less than do singly owned stations. When the results are disaggregated by market size and analyzed separately for 1964 and 1965, singly owned stations have lower rates with the exceptions of markets 51–100 and markets 101–150 for 1965.[25]

In another report based on the same study, Levin[26] notes that "the URI analysis of prime 20-second spot rates for 464 TV stations in 1964 and 1965 reveals no significant difference in CPM's (cost per thousand viewers) as between group and non-group stations in the top 100 markets. In the third fifty markets, group owners do command slightly higher rates, but in the smallest markets (151 and over) the single owners do so even more."[27]

Although this evidence suggests that groups do not exert leverage in their dealings with advertisers, the Cherington study has weaknesses. It reports averages of rates for group owned and singly owned stations

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[22]The FCC's Network Inquiry Special Staff reached, and verified, the same conclusion regarding the respective clearance rates of network owned and affiliated stations although it did so through a different route than did Wildman. See, Federal Communications Commission, Network Inquiry Special Staff, *New Television Networks: Entry, Jurisdiction, Ownership, and Regulation*, Vol. II, October 1980, at 247–53, 260–268, and 273–86.

[23]P. W. Cherington, L. V. Hirsch, and R. Brandwein, *Television Station Ownership: A Case Study of Federal Agency Regulation*, Hastings House, New York, 1971.

[24]Id., at 54.

[25]Id., at 54.

[26]H. J. Levin, "Competition, Diversity and the Television Group Ownership Rule," 70 *Columbia L. Rev.* 791 (1970).

[27]Id., at 798.

within particular ranges of market size (like markets 51–100) rather than differences within *specific* markets. Conceivably in some markets large differences could exist without much affecting the average for the category. The study fails to assess the statistical significance of the observed differences in rates. Nor does it control for other variables, such as the age of stations, family incomes, differences in market competition, and other characteristics that could affect the results.

In another study, Levin estimates a number of regressions that explain a station's 20-second spot rate.[28] The large number of equations reported and the wide variety of specifications employed make it difficult to briefly summarize his findings. In one set of results, group ownership has no significant effect on advertising rates, in another the effects are mixed, and in others, group ownership significantly raises advertising rates. In all cases, ownership by a network significantly raises a station's rates. It is impossible to identify why the effect of group ownership varies from equation to equation, since Levin's equations are complex and he does not conduct explicit sensitivity tests.

Program Prices

The expected effects of group efficiencies, leverage, and collusion on program prices are the opposite of their effects on advertising rates. Lower operating costs conferred by group ownership would tend to increase the demand for programs, forcing program prices upward, whereas collusion among groups or leverage exerted by individual groups would tend to force program prices downward. Thus, cases 1 through 5 discussed earlier are applicable, but with the directions of effects reversed.

The FCC's Network Inquiry Special Staff tested the hypothesis that group owned stations are able to obtain more favorable terms than singly owned stations from program suppliers, by analyzing the determinants of the prices paid by stations per viewer-minute for syndicated off-network programs.[29] Controlling for the amount of competition for programs, the staff found that the price per viewer-minute is significantly *higher* when the purchaser was owned by a large group or by a network. These results fail to support the hypothesis that group owners are able to take advantage of their position to acquire programs at lower prices than can those of their singly owned rivals.

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[28]H. J. Levin, *Fact and Fancy in Television Regulation*, Russell Sage Foundation, New York, 1980, at 147, 153, 175, and 183.

[29]Federal Communications Commission, Network Inquiry Special Staff, "An Analysis of Television Program Production, Acquisition and Distribution," in *New Television Networks: Entry, Jurisdictions, Ownership and Regulation*, Vol. II, October 1980, at 641–650.

The finding that groups pay more for programs is, however, a puzzle. One possible explanation stems from the linear relationship assumed between program prices and the number of viewers. If this relationship is nonlinear, and if group owned stations tend to be in larger markets and thus command larger audiences than the average station, a variable representing group ownership will show a positive effect on price per viewer.

Network Compensation

Leverage by groups could also be manifested in compensation paid to network affiliates. The Barrow report,[30] in particular, asserted that network-affiliated stations owned by large groups are able to obtain greater compensation from the networks than their singly owned rivals.

> Multiple station owners, by bargaining with networks, national spot representatives, and independent program suppliers for their group of stations as a whole, have been able to obtain more favorable terms which give them a competitive advantage over single station owners. . . . In bargaining with networks, the multiple station owner is in a position to seek network affiliation for all his stations, to have stations placed on the "must buy" list, and to establish the rates for his stations and the division of compensation between the network and the stations on a more favorable basis than the standard network arrangements.[31]

The Network Inquiry Special Staff examined this assertion. After controlling for (a) the audience delivered by the affiliate, (b) the strength of the network with which it is affiliated, and (c) the presence and strength of independent stations that might compete for the affiliation, the staff found no significant difference between compensation received by stations that are members of the 10 largest stations groups and all other stations.[32] This result, like that for syndicated program prices, further weakens the case for the proposition that group owned stations exercise leverage to the disadvantage of their singly owned rivals.

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[30]U.S. Congress, House of Representatives, Committee on Interstate and Foreign Commerce, 85th Congress, 2d Sess., *Network Broadcasting* (January 1958).

[31]Id., at 565.

[32]FCC, "An Analysis of the Network-Affiliate Relationship in Television," op. cit., at 259–260 and 269–283.

Network Affiliation

The exercise of bargaining power by station groups might also be expected to be manifested in their ability to obtain better network affiliations than their singly owned rivals. Again, the Barrow report asserts that this is the case.[33] However, the Cherington study challenges this claim. Presumably, if groups were able to exert such influence, they would tend to be affiliated with NBC and CBS, the stronger networks at that time, rather than with ABC. Yet, in the top 50 markets ABC "had the same proportion (33%) of stations affiliated with it for both group and single owners."[34] Moreover, for both the top 50 markets and for all markets, the percentage of network affiliated group stations is only slightly greater than the percentage for nongroup stations—79 percent vs. 73 percent in the top 50, and 93 percent vs. 86 percent in all markets.

Profit Margins

Differences in profit margins between group owned and singly owned stations is another way that the exercise of market power by groups would be manifested.[35] The Cherington study concludes, however, that, except for the smallest markets, there are no substantial differences in profit margins between group owned and singly owned stations.[36] Drawing from station financial data collected by the FCC for 1964, the study finds consistently higher profit margins for group owned stations for all size markets. But the differences are small except for markets below 150 where group owned stations showed a profit ratio of 15.1 percent as against a loss of 1.7 percent for singly owned stations. Among network affiliated stations classified by net weekly circulation, singly owned stations outperform group owned stations in markets with more than 500,000 net weekly circulation, whereas group owned stations show an advantage in the smaller markets.

As in its inquiry into advertising rates, the Cherington study fails to assess the statistical significance of the differences in profit margins

[33]Op. cit., at 566.

[34]Cherington et al., op. cit., at 46.

[35]This comparison tests whether leverage is being exerted by group owners if group owned stations are no more efficient than their singly owned rivals. If market power is exercised collusively as a result of group ownership, and if all stations are equally efficient, there will be no difference in profitability, since collusion benefits all stations. If group owned stations are more efficient, any difference in profitability will reflect that factor as well as the effect of any leverage that they exercised.

[36]Id., at 60–65.

reported, or to control for other factors that may affect the results. Moreover, the quality of the underlying data is subject to substantial question, since there was no requirement that the data be provided to the Commission on a consistent basis, nor did the FCC audit the data that were submitted.[37] Nevertheless, this pattern of results is intuitively plausible. If groups bargain unfairly or collude, they would likely be successful in doing so in smaller, less competitive markets.

Levin also examines whether the presence of group owned stations in a market significantly increases station profitability.[38] He uses published FCC data on *market* income to estimate profit per *station* and then relates profit per station to, among other things, the proportion of group owned station in the market. His results are generally negative. He reports, for example, that "group ownership [has] only weakly significant effects . . . on the market averages of income. . . ."[39] And, in another estimate in which the effect of public television is taken into account,[40] he finds that the effect of group ownership on average station income is not significant. However, Levin's results are consistent either with the hypothesis that group owned stations do not have higher profits than singly owned ones or with the hypothesis that group ownership redistributes profits among the stations in a market without affecting the amount to be divided among them.

Is There Reason To Expect Anticompetitive Behavior?

Because the abolition or relaxation of the Commission's group ownership rules might change the behavior of groups in ways that would not be disclosed by past empirical studies, we use economic analysis here to assess the likelihood of the two forms of anticompetitive activities discussed above: (a) the use of leverage by individual groups, and (b) collusion among groups.

The Leverage Hypothesis. On theoretical grounds the leverage hypothesis is implausible. Consider a hypothetical group owner of the sort described by Coffey. Suppose that the program in question is worth 100 to him in market 1, 50 in market 2, and 20 in market 3, in that he is willing to pay up to these amounts rather than carry his best alternative. Rival stations in each of these markets value the program at 90, 40, and 30, respectively. Without leveraging, the group owner

[37]For a discussion of these data see R. E. Park, L. L. Johnson, and B. Fishman, *Projecting the Growth of Television Broadcasting: Implications for Spectrum Use*, The Rand Corporation, R-1841-FCC, February 1976, at 100–106.

[38]*Fact and Fancy in Television Regulation*, op. cit.

[39]Id., at 150, based on results reported at 144.

[40]Id., at 255.

will carry the program in markets 1 and 2 and another station will carry it in market 3. If each purchaser pays the minimum price necessary to acquire the program in a market, producer revenues will be just over 150 (= 90 + 40 + 20), the group owner's surplus will be just under 20, and the surplus of the nongroup owner is market 3 will be just under 10, for a total of 180. If the prices paid exceed these minima, the surpluses of station owners decrease and the profit of the producer increases, but the total remains unchanged at 180.

Now consider a situation in which the group owner, using his leverage, attempts to acquire the program in all three markets. If he succeeds, the amount available to be divided between the group owner and the program producer is 170 (= 100 + 50 + 20). If we call the combined price paid by the group owner P, the producer's revenues are, of course, P and the group owner's surplus is 170 − P, for a total of 170.[41] But the producer can offer an alternative deal in which the group owner acquires rights only in markets 1 and 2 for a combined price that is smaller than P by (20 + e1). The supplier then sells the rights to the nongroup owner in market 3 for 20 + e2 where e2 > e1. The group owner's surplus rises by e1, the nongroup owner's surplus rises by 10 − e2, and the producer's revenues rise by e2 − e1. The total surplus is now 180 rather than 170 in the case where the group owner acquires the rights to the program in all three markets.

However, might not the group owner find it in his long-term interest to accept a short-term loss to deny programming to the nongroup owner in market 3 and, possibly, drive him out of business? Such behavior by the group owner seems implausible because of the stringent conditions that must be met for the short-term losses to be more than offset by the increase in long-term profits. First, since all other stations in the market would share in the audience inherited from the singly owned station, the benefits against which short-run costs must be compared are commensurately reduced. Unless these stations can somehow collude against the single station owner—cooperative action that becomes increasingly difficult as the number of stations in the market increases—a group owner may gain little by trying to use his leverage against a single station.

Leveraging seems to pose the greatest danger—if there is a danger—in the smallest markets with only two or three stations, where cooperative behavior to eliminate other stations would be most easily accomplished. But here we face a second problem. Stations in such small markets are network affiliates, giving them assured access to

[41] P must, of course, be at least 160, the combined amount available from other stations in the three markets.

much of their required programming regardless of the group owner's behavior.[42] Moreover, the amount of syndicated programming available per station is larger in small markets than in large ones. Attempts by a group owner to deny programming to his competitor would likely be frustrated by a high elasticity of program supply resulting from the existence of many sources from which the singly owned station in a small market can buy.

Third, once the group owner seeks to recoup his losses by drawing from a larger audience and driving down the price of programming in market 3, he must be assured that no one else will enter. Unless it is costly to reestablish the station, others may try to enter the market to capture some of these profits.[43]

Fourth, in addition to the single station owner, the program supplier would, in the long run, also be disadvantaged by the exercise of leverage by the group owner to exclude his rival, since the demise of the singly owned station leads to a reduction in the price of programs. If suppliers anticipate this outcome, however, they can enter into long-term contracts with the singly owned station to protect it against predation.[44] If such long-term contracts are possible, the problem reverts to the formulation described above. The group owner will find it more profitable *not* to purchase the program in market 3, since the supplier can offer him a better deal when he does not do so.[45]

Collusion. Consider two simple cases in which collusion among groups would be no more likely than among singly owned stations. In the first, no firm regards placing an advertisement in one local geographic area as substitutable for advertising in another. Thus, for example, if all advertisers were local automobile dealers, they would value advertisements only on stations that serve their marketing areas. It would make no difference, say, to a dealer in Washington, D.C., that advertising rates were higher there than in Baltimore, if his customers were drawn solely from the Washington area. Here, even if the *same*

[42]Indeed, under Section 73.658(1) of the FCC's rules, in markets where two stations are affiliated with networks and a station with "reasonably comparable facilities" is not, the affiliates are prohibited from taking prime time and weekend sports programs from their secondary networks unless the unaffiliated station has been offered the programs.

[43]On the contestability of markets, see W. J. Baumol, J. C. Panzar, and R. D. Willig, *Contestable Markets and the Theory of Industry Structure*, Harcourt, Brace Jovanovich, Inc., New York, 1982.

[44]The use of long-term contracts as a response to predation is discussed by F. H. Easterbrook, "Predatory Strategies and Counterstrategies," 48 *University of Chicago Law Review* 263 (1981), at 270–71.

[45]Note that nothing in the predation argument requires that the predator be a group owner. Conceivably, even the owner of a single station could bid more for a program than it is "worth" to him to deny it to his rivals in the hope that they will be driven out of business.

set of owners held stations in both Washington and Baltimore, they would have no greater ability to collude than would singly owned stations.[46]

The second case is one in which (a) firms regard advertising in two geographic areas as substitutes, so that if the prices in the two markets diverge, they will make all of their purchases in the lower-price market, and (b) group owners face one another in different combinations in the two geographical areas. Suppose, for example, that all advertisers in Washington and Baltimore are indifferent as to where their advertisements appear.[47] Suppose, moreover, that the stations in the two cities are all group owned but that no one owns a station in both cities. Under these assumptions, the number of station owners that would have to collude to raise advertising rates is unaffected by the existence of group owners in the two markets. To raise rates to the Baltimore-Washington customers, all of the stations in both cities would have to agree on prices—and this number is not reduced by the presence of group owners in both. In other words, the number of owners is no smaller than the number of stations, despite the fact that some stations are members of groups.

This analysis suggests two conditions that must both be met for group ownership, through collusion, to be an effective way to raise advertising rates. First, the geographic areas in question must constitute a single relevant market. Two metropolitan areas containing stations that reach distinct groups of viewers might be in the same advertising market if a significant number of firms with rising short-run marginal cost curves sell products in both areas. In such circumstances, a fall in the price of advertising in one area induces such firms to increase their advertising and sales in that area. This, in turn, raises marginal production costs and reduces the incentive to sell and to advertise in the other. Whether there are enough firms that behave in this way to produce linkages among geographically dispersed advertising markets remains an open question.

Second, the number of station owners in the relevant market must be smaller than the number of stations in the market. Thus, if a collection of cities represents a relevant market, the presence of group

[46]This condition is actually too strong. All that is necessary is that *at the margin* no advertiser is willing to substitute between the two areas.

[47]Again, this condition is too strong. All that is required here is that enough advertisers are indifferent at the margin between the two areas that they are willing to shift advertising expenditures between them when price divergences appear. Thus, not all advertisers need regard advertising in the two cities as substitutes, nor need any particular advertiser do so for his entire advertising budget.

owners in these cities will not affect prices if no group owns more than a single station in the market.[48]

This second condition, however, is only necessary and not sufficient for collusion to occur. If the relevant geographic market is large, the fact that some entities own more than a single station in the market may be of little consequence if there are many other competitive stations in the market. Thus, if the relevant market were defined as the entire United States, where the number of stations is clearly greater than the number of station owners, effective collusion is rendered unlikely by the large number of different station owners.

If the number of owners is below the number of stations, we must consider an additional factor: The presence of overlapping group owners must reduce the number of owners *sufficiently* below the number of stations to render collusion a feasible option. Moreover, a simple count of the number of nongroup owners will generally be inadequate to assess the effect of overlapping group ownership on the opportunity for collusion. Group owners who possess a relatively small market share are less a threat than those with large shares. Therefore, a combination of independent UHF stations in, say, Washington and Baltimore will be of less concern than a combination of network-affiliated VHF stations.

Where, then, would we expect group station ownership to affect advertising rates through collusion? A likely candidate would be a collection of cities in relatively close geographic proximity to one another, where several owners are represented in more than one city and where the total number of stations is small. Geographic proximity is important because it makes more likely the substitution of advertising in one

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[48]Group ownership may facilitate collusion even if metropolitan areas are the relevant markets. This would occur if the same groups are present in more than one area and the costs of collusion are not proportional to the size of the combined markets in which the groups operate. To detect such collusion, it is necessary to take into account not only the number of group owned stations in a metropolitan area but also their identities.

Scherer argues, however, that collusive behavior can be promoted by the presence of firms in more than one market even if each firm faces different firms in each market: "If rivals come to fear from a multimarket seller's actions in Market A that entry or expansion in Markets B and C will be met by sharp price cuts or other rapacious responses, they may be deterred from taking aggressive actions there. Then the conglomerate's expected benefit from predation in Market A will be supplemented by the discounted present value of the competition-inhibiting effects its example has in Markets B and C." F. M. Scherer, *Industrial Market Structure and Economic Performance*, Second Edition, Rand McNally, Chicago, 1980, at 338. See also D. M. Kreps and R. Wilson, "Reputation and Imperfect Information," 27 *J. of Econ. Theory* 253 (1982); and P. Milgrom and J. Roberts, "Predation, Reputation, and Entry Deterrence," 27 *J. of Econ. Theory* 280 (1982). This theory implies that the mere presence of group owned stations in a market may facilitate collusive behavior, since the group owners will wish to cultivate their reputations for aggressive behavior to discourage competitive behavior elsewhere. The evidence on the effects of group ownership discussed above tests, and generally rejects, this hypothesis.

city for advertising in another. The limiting case is, of course, where the stations are in the same city.[49] The fact that several owners are represented in more than one of the cities is important because it reduces the number of owners substantially below the number of stations.[50] Finally, a small number of stations is important because there the presence of several groups owning stations in more than one city can more easily lead to sufficient concentration to make collusion feasible.

The preceding discussion focused only on advertising markets. But behavior in program markets is also relevant. Here the argument that group ownership creates market power is weaker than in the case of advertising, because the relevant market for programming is likely to be geographically smaller than that for advertising. The reason is that geographically separated markets do not represent alternative ways in which a program supplier can market its products. A sale of a program to a station in Washington does not affect the ability of the supplier to sell the same program to a station in New York. Consequently, so long as the signals of two stations do not substantially overlap, they are not in the same market from the point of view of program suppliers.[51] Since television stations located in geographically separated markets do not compete with one another for audiences, a program syndicator wishing to sell a program to stations in two separate cities will regard each of those cities as distinct markets and establish the prices of its programs separately in each.

GROUP OWNERSHIP AND AD HOC NETWORKS

Two views have been advanced about the effect of relaxing the numerical limit on the size of television station groups on the viability of ad hoc, or occasional networks, that broadcast individual programs rather than an extensive program lineup. The FCC, in discussing why it favored a relaxation of the limit, referred to "the inhibiting effects of

[49]Advertisers of national brands may, however, regard advertising in two cities that are far apart as close substitutes, at least at the margin.

[50]Again, if no entity owns a station in more than one of the cities that make up the relevant market, group ownership creates no additional market power.

[51]An exception might appear to be so-called "superstations" whose signals are carried into many cities for distribution by cable systems. Under some circumstances, the sale of a program to a superstation might preclude sales to stations in the markets served by these cable systems. However, this situation is more appropriately analyzed as a sale to a network, where network distribution probably precludes, for a period of time, the sale of the same program to individual stations.

the rule in the development of new programming."[52] In this view, allowing groups to expand in size will, by assuring them outlets for their programming, permit them to compete more effectively with the three major networks by providing network programming on an occasional basis.

The Motion Picture Association of America has argued that any relaxation of the limit on the size of television station groups should not apply to the three major networks.[53] MPAA contends that increased station ownership by the networks would foreclose access to network owned stations by ad hoc networks, thus reducing competition in the network market.

We are skeptical about both of these arguments. It is by now well established that the most important barrier to the creation of new networks is the FCC's spectrum allocation plan for television.[54] The inability of a new network to reach a substantial portion of the viewing public using existing stations, and the fact that many of its affiliates would have to operate in the less attractive UHF band, combine to make a fourth network unlikely in the near future. Relaxing the FCC's group ownership rules would do little to alter this situation. A marginal impact might result from the ability of a group to assure the carriage on its own stations of programs that it produces or distributes, but the same result could be achieved by amending the Commission's network affiliation rules.[55] But permitting groups to grow larger is unlikely to alter the considerable economic advantage that the major networks have as result of offering to their affiliates a program lineup that covers a substantial portion of the broadcast day. It is improbable, therefore, that permitting groups to grow in size will make ad hoc networks substantially more competitive.

The argument put forth by the MPAA is no more compelling. Affiliates of the major networks already carry a very substantial proportion of the offerings of those networks and the proportion is unlikely to be greatly affected by network ownership.[56] Therefore, only if a network were to own or affiliate with more than one station in a market would the threat to which MPAA refers be a real one. But the FCC, in proposing to relax its rules, indicated that it would not permit a network

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[52]FCC, *Report and Order*, adopted July 26, 1984, released August 2, 1984, at para. 63.

[53]"Hollywood and the FCC Argue 12-12-12 and Network Domination," *Broadcasting*, August 6, 1984, at 29.

[54]See, for example, R. E. Park, *New Televison Networks: An Update*, The Rand Corporation, N-1526-FCC, August 1980.

[55]See FCC, op. cit., Vol. I, at 475–485.

[56]Id., Vol.II, at 257–268.

to affiliate with one station in a market in which it owned another.[57] Thus, the concern expressed by MPAA does not appear to be important.

The conditions under which leveraging would be viable are so stringent that such behavior is most unlikely. Collusion is a less remote possibility if group ownership reduces the number of owners relative to the number of stations to such an extent that concentration is high in the *relevant* markets. The upshot is that a primary goal of the Commission should be to prevent undue economic concentration in such markets. We discuss below the options available to the Commission and how well they are likely to meet this goal.

ECONOMIC EFFICIENCY

Program Ratings

If group owned stations enjoy lower costs than do singly owned stations (or if they exercise leverage in dealings with or collude against program suppliers), we would expect them to broadcast programs with higher audience shares or ratings than do their rivals. An empirical study on this subject, by Parkman, suggests that local news programs produced by group owned stations do tend to attract larger audiences.[58]

Parkman uses a multiple regression analysis in which the dependent variable is audience rating and the independent variables include joint ownership with other television stations. The ratings data, for the years 1965 and 1975, are drawn from local television news programs in the top 100 markets. Parkman finds that, for 1965, group ownership has a positive but statistically insignificant effect on local television news ratings. However, for 1975 there is a positive and statistically significant effect. Indeed, the coefficient of the group ownership variable is the largest of the three ownership variables and is the only one that is statistically significant. In 1975, the group ownership coefficients are of substantial size, showing that group ownership increases ratings by 2.65 and 1.99 for the early and late news programs respectively, compared with average market ratings of 12.02 and 9.97.

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[57]FCC, *Report and Order*, adopted July 26, 1984, released August 2, 1984, at para. 98.

[58]A. M. Parkman, "The Effect of Television Station Ownership on Local News Ratings," 64 *Rev. of Econ. & Stat.* 289 (1982).

To be sure, higher program ratings could result from anticompetitive behavior as well as from greater economic efficiency. However, Parkman's study covers only local news that is produced by the station, rather than including also syndicated programming where any effects of leveraging or collusion would more likely show up. Thus, his study is useful in suggesting that groups do enjoy cost advantages, at least for local news production. As Parkman says, his "results would tend to support the contention that group owners were able to adapt to changes in the production techniques of local TV news programming better than other owners with a resulting higher audience."[59]

Profit Margins

If group ownership confers efficiencies, we would expect profit margins to be higher for stations that are members of groups than for other stations, regardless of whether groups engage in anticompetitive behavior. However, as discussed earlier, both the Levin (1980) and Cherington studies find that these margins do not differ significantly between group owned and other stations, suggesting that the cost advantages of group ownership are small.

Advertising Rates

We would also expect advertising rates to be reduced if efficiencies result from group ownership. However, even if groups are more efficient, if group ownership facilitates collusion or permits the exercise of leverage, rates could be higher in markets where group owned stations have large shares if the effects of anticompetitive behavior offset those of greater efficiency. The basic tenor of the results reported above, however, is that the presence of group owned stations in a market does not affect advertising rates. This can result either because group ownership does not create efficiencies or because the effects of greater efficiency and greater collusion are offsetting.[60]

However, the findings by Levin and Wildman, discussed earlier, that network owned stations have higher per viewer advertising rates than

[59]Id., at 294. In the welter of empirical tests carried out by Levin (1980), op. cit., he also examines the relationship between audience size and group ownership. The general tenor of his results appears to be that there is no significant relationship. See, for example, tables at 175 and 183.

[60]This discussion implicitly assumes that advertisers are concerned only with the cost per viewer reached, so that rates per viewer are identical for all stations. However, if advertisers are willing to pay higher rates per viewer to stations with larger audiences, group owned stations will have higher rates if their greater efficiency produces larger audiences.

do their rivals may constitute evidence of group efficiencies. Differences in rates would arise if economies permit the group owned station to provide programs that attract larger audiences, and if advertising rates rise faster than audience, i.e., the relationship is nonlinear.[61]

Station Programming Practices

We would expect group efficiencies to be exhibited in centralized purchases of syndicated programming, and strong control by headquarters over local station activities, as ways to reduce transactions costs and to spread overhead. The evidence suggests, however, that local stations exercise a good deal of autonomy, implying that group efficiencies are weak. We review this evidence in the subsequent subsection on program diversity, where it is especially relevant.

Growth of Group Ownership

If large economies flow from group ownership (or if groups engage in anticompetitive activity) we would expect rapid growth in group ownership. Surely, if there were large economies of group operation, or opportunities to exert leverage or engage in collusive behavior, significant incentives would exist for groups to purchase singly owned stations. If so, we probably would have seen rapid growth of groups after the FCC's 1954 decision increasing the ownership limit to seven stations, with many or most groups at the limit. However, in mid-1984 only 15 of the 175 television station groups owned seven stations. Only one had the full complement of seven television, seven AM radio and seven FM radio stations, and a total of 27 groups held the limit of five VHF stations.[62] In 1982, almost 20 percent of the nation's 518 VHF stations remained singly owned.[63]

The growth of group owned stations has proceeded at a steady but not strikingly rapid pace. During the 26-year period from 1956 to 1982, the percentage of group owned television stations grew from 45 percent

[61]One might suppose that group efficiencies (as well as anticompetitive behavior) would show up in station selling prices, which would be higher when a station is purchased by a group than by a nongroup. Indeed, both the Levin and the Cherington studies extensively analyze station selling prices by type of buyer and seller to test this proposition. However, this evidence is irrelevant to the question. Even if groups have advantages over nongroups, they would not pay higher prices when purchasing stations. However, if groups have efficiency advantages, they would tend to outbid others and, thus, buy stations from nongroups.

[62]*Broadcasting*, July 30, 1984, at 30. These numbers include currently announced sales with transfers of ownership pending.

[63]*Notice of Proposed Rulemaking*, at 25.

to 72 percent, with a substantial number of stations—219 out of 790—remaining in the hands of individual owners.[64]

An anomaly in the pattern of empirical evidence, however, is the higher concentration of group ownership in the larger markets, despite the fact that profit margins of groups are higher than for singly owned stations in the smaller markets. Howard reports that as of January 1, 1983, 94.7 percent of the VHF stations in the top 25 markets were group owned, compared with 68.3 percent in markets 75–100. For VHF and UHF combined, the respective numbers are 81.6 percent and 69.6 percent.[65] The Cherington study discloses that (in 1964) the profit margins of group and singly owned stations were nearly the same in the top 50 markets (39.1 percent vs. 37.4 percent) but that the difference was greater in markets 50–100 (24.3 percent vs. 18.1 percent).

One might argue that groups are attracted to the larger, more lucrative markets where the *dollar* profits are higher—all the more so if groups are limited as to the number of stations they may own. But this explanation is flawed. In the first place, the FCC constraint is not binding on most groups. Owning fewer than the permitted number of stations, they are free to expand into the smaller markets. Second, if the markets with smaller dollar profits are less attractive to group owners, they should also be less attractive to *single station* owners. The lower profits of stations in small markets do not, therefore, explain why group owners are less well represented in these markets than in the large ones. Third, whatever economic advantages would accrue from centralizing management, spreading program costs over larger audiences, reducing (per-viewer) costs of marketing, and such would likely be more important for small rather than for large markets. If so, however, we would expect greater, rather than less, group ownership in smaller markets than in larger ones.

DIVERSITY IN PROGRAMMING

The final category of evidence about the effects of group ownership concerns program diversity. Defining diversity is not a straightforward matter. For some, it refers to the variety of viewpoints expressed in the editorials presented by various stations. By this definition, group ownership reduces diversity if the views presented by stations that are members of a group are more similar than those of stations that are

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[64]Id.

[65]H. H. Howard, *Group and Cross-Media Ownership of Television Stations in 1983*, National Association of Broadcasters, Washington, D.C. (1983), at 6.

not under common ownership.[66] Others view diversity as referring to the types of programming presented on various stations. From this perspective, group ownership reduces diversity if the range of program types provided by group owned stations is smaller than that provided by stations that are individually owned.

The Cherington study is one of the few that shed light on this issue. The analysis involved (a) sending questionnaires to all of the 532 commercial stations in the country, of which 15.2 percent were returned, and (b) conducting 35 interviews "with a representative cross-section of station managements, a majority of which had not answered the questionnaire."[67]

The authors conclude that group ownership has little effect on opinion molding or on editorializing. Responses from both group owned and singly owned stations disclosed that the station manager and news director have "moderate" to "great" influence on editorial positions. For group owned stations "headquarters" and the "owner" played "very little" role, whereas for single owner stations, the "owner" played a "moderate role."[68] For both types of stations, the national wire services network news organizations and station reporting staff were of "moderate or great importance," whereas group news organizations for the group owned stations was of "very little" importance.[69] The interviews also disclosed a high degree of autonomy by station managers in the selection of programming.

If there were significant group efficiencies, one would expect them to arise in part from the economies of centralized management, news collection, and presentation. However, if station managers operate as autonomously as is described in the Cherington study, and if they rely so little on headquarters for news content, the economies of group ownership are likely to be small.[70]

The Cherington study is subject to the obvious criticism that the low response rate of 15.2 percent to the questionnaire could have introduced a self-selection bias. And the evidence is based on self-reporting by station respondents rather than on data about how stations actually behave. A content analysis of programs carried by group and singly owned stations, while tedious and costly to perform, would provide a far better measure of differences in programming.

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[66]Robert Crandall argues, however, that viewers in small cities may benefit from exposure to ideas originating in larger ones, where otherwise they might receive only the parochial viewpoints of local stations owners.

[67]Cherington et al., op. cit., at 82.

[68]Id., at 93.

[69]Id., at 87.

[70]It is possible, of course, that station managers claim more autonomy than they actually have.

More recently, Levin[71] reports that

> a reduction in group ownership would have no impact on diversity, however measured, so long as network affiliations remained unchanged. . . . Loss of a group tie would have deprived viewers of no more than 3.5 minutes of news daily, and of 5.5 minutes of non-network shows, whereas public affairs, fine arts, and local programming would each have remained unaffected. . . .

He also concludes that "the loss of group ties . . . has no significant programming effect, nor any even approaching significance."[72]

In response to the FCC's *Notice of Proposed Rulemaking* on group ownership, Capital Cities Communications and Knight-Ridder Newspapers commented that

> [T]he employment and supervision of key station personnel at Knight-Ridder stations are conducted by the station managers, with only very generalized review by corporate headquarters. Each of the company's stations makes its own selection of national news sources. Some use UPI; some, AP; some, both wire services. The format of local news programs is also a matter committed to station discretion. Knight-Ridder's Flint station, for example, extended its news program to an hour, and later compressed it to half an hour, both at the initiative of the individual station manager.[73]

As with the Cherington study, this situation suggests that group ownership does not reduce diversity—nor does it contribute significantly to economic efficiency.

Also in response to the FCC's Notice, the National Association of Broadcasters conducted a study of 107 group and nongroup owned commercial television stations in 29 markets. The percentages of a broadcast day devoted to public service programming were measured using *TV Guide* listings for a randomly selected composite week.

> The results of the study indicate that overall, group-owned stations offer more public service programming than non-group owned stations. Group-owned stations devoted 18.4%, 10.1% and 32.0% of an average broadcast day to informational, local and total non-entertainment programming. Non-group owned stations devoted 12.9%, 6.9% and 24.8% of a broadcast day to these same program categories.[74]

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[71]Levin (1980), op. cit., at 170–171.

[72]Id., at 205. Program minutes is not the only possible measure of diversity, of course.

[73]Comments, FCC Gen. Docket 83–1009, January 19, 1984, at A-4.

[74]Comments of the National Association of Broadcasters, FCC Gen. Docket No. 83–1009, January 19, 1984, at 1.

These data also suggest that group owned stations promote diversity, provided one accepts additional public service programming as a valid measure of additional diversity.

In view of the great importance that the FCC has, for decades, placed on maintaining and expanding diversity, we are surprised by the paucity of empirical analysis directed to the question of whether its group ownership rules, in fact, contribute to or compromise attainment of this fundamental goal.[75]

Our review of the empirical evidence does not leave us with much confidence that the effects of group ownership are well understood, since many of the studies have important shortcomings. The best that can be said is that the studies are consistent with the view that the economies of joint station operation are small and that, as suggested by theory, group ownership does not create market power. Only Parkman's study demonstrates that costs are significantly lower for group owned stations, although the Levin and Wildman findings are consistent with the presence of group efficiencies. Nor is there evidence that groups, other than those controlled by the networks, significantly raise advertising rates. In the case of network owned stations, the evidence is mixed, with the Wildman and Levin studies suggesting that they charge higher rates than do other stations in their markets, the Fournier and Martin study indicating that rates are no higher in *markets* with network owned stations, and the Wildman study concluding that rates are no higher for *other stations* in markets containing network owned stations.

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[75]One opportunity to assess the effects of group ownership on programming was, however, missed. In *Broadcasting in America, The Performance of Network Affiliates in the Top 50 Markets*, 42 FCC 2d 1 (1973), a group under the direction of FCC Commissioner Nicholas Johnson surveyed the programming practices of a large number of television stations. The authors "had hoped to be able to compare the performance of the 'media barons' — the corporate owners possessed of conglomerate interests both within and without the various media — with that of independent local owners who would have no such outside interests. That comparison has proved impossible, because it is apparent . . . that virtually none but a small handful of those network affiliates would qualify as even reportedly resembling 'local' owners." (at 71) Unfortunately, having failed to distinguish among station groups, newspaper ownership, and ownership by corporations engaged in non-media activities, the authors did not examine separately the performance of group owned stations nor compare the performance of the largest groups with those of other stations.

In view of the limited utility of the evidence, one must place more weight on a priori analysis than is perhaps desirable. Our analysis, which is broadly consistent with the empirical evidence, indicates that group ownership is unlikely either to enhance efficiency or create market power. The issue of collusion may be a problem, however, if group ownership becomes regionally concentrated. We consider the Commission's recently abolished regional concentration rule in Sec. III.

POLICY IMPLICATIONS

The past growth of group ownership, and the lack of evidence about strong group economies and anticompetitive practices, suggest that no dramatic increase in group ownership will occur as a result of the relaxation of the group ownership rules.[76] With changes resulting from the relaxation of the rules moving slowly, the Commission could monitor the evolution of the industry and take further action if developments in the industry warrant.

But this assessment cuts both ways. Why, one might argue, if the economic advantages of group ownership are modest, should one take the risk that increased concentration might reduce diversity or create greater market power?

The answer is that in *particular* situations, substantial gains in economic efficiency might result if groups were permitted to expand beyond current limits. The fact that past studies do not disclose large and consistent differences between profit margins of group and singly owned stations, for example, does not necessarily mean that in all cases group ownership confers few economic benefits. The existing pattern of ownership reflects decades of marketplace "selection" of stations into group and singly owned categories. Simply put, group owned stations are likely to be those that most benefit from group ownership. Hence, were they singly owned, their profit margins would be lower. Similarly, stations that operate well as single entities are likely to show relatively high profit margins. Consequently, it is not surprising that singly owned (network affiliated) stations with large new weekly circulations have higher profit margins than do group owned stations, as

[76]Trade press reports following the modification of the group ownership rule suggests that, although the change will permit some transactions that would otherwise not have occurred, the effect will not be great in the near term. See, "How Will Market React to New Limits?," 107 *Broadcasting* 29 (1984). Dertouzos and Thorpe argue that the estate- and income-tax laws create important incentives for shifts from single to group ownership. For an analysis of these incentives in the case of newspaper groups, see J. N. Dertouzos and K. E. Thorpe, *Newspaper Groups: Economies of Scale, Tax Laws, and Merger Incentives*, The Rand Corporation, R-2878-SBA, June 1982, at 55–82.

reported in the Cherington study. If they did not have such profit margins, they too would likely have been acquired by a group.

A possible benefit of relaxing the Commission's group ownership rules is, therefore, that the process by which stations decide whether or not to become part of a group is now less constrained. As the industry continues to evolve, with the status of particular stations changing as a consequence of competition, changes in management, and other circumstances, the advantages of being a member of a large group will also vary. Perhaps singly owned stations whose profit margins are healthy today will see their margins decline in the future. If so, the economic attractions of joining a group may increase. Relaxation of the FCC's rules gives these stations and group owners greater freedom of choice in making matches that contribute to the economic health of the broadcasting industry.

OPTIONS FOR MODIFYING THE GROUP OWNERSHIP RULE

We conclude this section by examining three options that were available to the Commission in reconsidering its group ownership rule. The first—which was adopted by the Commission—would simply increase the permissible number of stations beyond the current limit of seven. The second would have limited the total audience that may be reached by a group with audience measured, for example, by net weekly circulation. The third would have the Commission consider combinations of stations case by case in a manner similar to that employed by the Department of Justice under its merger guidelines.

Option 1: Raise the Numerical Limit

Drawing from a range of possible rationales, the Commission could raise the numerical ceiling on group ownership. In its *Notice of Proposed Rulemaking*, the Commission describes M. O. Wirth's recommendation that the standard for radio should be modified "to allow one entity to own the same percentage of commercial stations nationally at present 'as they were allowed to do in 1953,' which would permit ownership of 72 radio stations without regard to type."[77] Transferring this proposal to television, the Commission notes that "a single entity would be permitted to own 14 television stations of any class, based on the number of commercial stations broadcasting when the seven station television limit was established in 1954 compared to the number

[77] *Notice of Proposed Rulemaking*, op. cit., at 49.

licensed in 1983."[78] In the end, the Commission adopted a "rule of twelve."

Adoption of such a rule is unfortunate. As is well recognized, the rule of seven was arbitrary to begin with. Indeed, the arbitrary nature of the rule was an important factor that has helped trigger the Commission's present inquiry. Any formula that sets a new fixed limit related is *no less* arbitrary. "A rule of twelve" (or any other number), like "the rule of seven," fails to take into account the extent to which the stations in a group compete with one another, nor does it reflect the importance of the stations in a group in the various markets in which they operate. In other words, a higher ceiling does not deal with the fundamental flaw of the present rule—that simple numerical limits have little merit.

Option 2: Impose Ceilings Based on Audience Size

As is well recognized, the present group ownership rule fails to distinguish between groups owning stations in the seven largest television markets and those owning stations in the seven smallest. Both such groups would be forbidden from acquiring an eighth station although one would reach over a 25 percent and the other fewer than one quarter of 1 percent of all households with television sets. Thus, some argue that a rule based on the audience served by a group would be superior to a ceiling on its number of stations.[79]

The problem with this option is that, like the "rule of seven," it does not take into account the locations of the stations that are part of a group. Common ownership of two stations in two adjacent small cities might have a far more anticompetitive effect than the ownership of seven stations in large markets that are far apart. It is not simply the number of stations that are owned by a group or the size of the audiences that they serve that determines whether group ownership is anticompetitive. Rather, it is the likelihood that the operations of the stations in the group can be combined to create market power. As we have argued above, this requires that the stations be in the same market, and two stations are more likely to be in the same market the closer they are located to one another. "Weighting" station ownership by the size of the audiences served would not overcome this limitation of the present rule.

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[78]Id., at 50.

[79]See Dissenting Statement of Commissioner Mimi Weyforth Dawson, July 26, 1984.

Option 3: Use A Case-By-Case Approach

This option involves two basic steps:

1. Determine whether the station being acquired is in the same market as a station owned by the acquiror. If it is not, grant the application. If it is, proceed to the second step.
2. Determine the present degree of concentration in the market and the increase in concentration that the acquisition will produce. If either (a) the market is unconcentrated or (b) the increase in concentration produced by the acquisition is small, grant the application. If the market is concentrated and the acquisition will substantially increase the extent of concentration, deny the application.[80]

Use of this approach can lead to the denial of applications that would be granted under present rules as well as to the granting of applications that would presently be denied. Thus, the owner of a single station who proposes to acquire a second station, both of which are in the same market, although not in the same city or ADI, may be denied the right to do so if the market is already concentrated and the two stations have substantial market shares.

In this regard, we agree with a criticism of the Commission's multiple ownership rules expressed many years ago by Commissioner Hennock: ". . . an interest in less than the permitted maximum number of stations, concentrated in one state or a given geographical region, may often have a more deleterious effect on competition and constitute a more stifling concentration than the ownership in excess of the permitted maximum scattered throughout the United States."[81] At the same time, Option 3 would permit the owner of seven stations to acquire others so long as either (a) the acquisitions are not in the same markets as any of his other holdings, or (b) the market is unconcentrated and the acquisition does not substantially increase concentration.

Although stating this procedure is straightforward, applying it in practice will be more difficult.[82] The Commission will be forced to deal

[80]This approach is identical to the one employed in the new Department of Justice Merger Guidelines: U.S. Department of Justice Merger Guidelines Issued June 14, 1982, 27 *The Antitrust Bulletin* 633 (1982). For a useful commentary on the Guidelines see G. J. Werden, "Market Delineation and the Justice Department's Merger Guidelines," 1983 *Duke Law Journal* 514 (1983).

[81]Separate views of Commissioner Hennock Concurring in Part and Dissenting in Part, 9 R.R. 1573, at 1575 (1953).

[82]In some respects, the application will be easier here than in the case of the DOJ Merger Guidelines, since the FCC can focus its attention on a single industry, with analysis developed for one case being transferable to others. The DOJ, on the other

with claims that the station to be acquired is not in the same market as other stations held by the same owner or, if it is conceded that the proposed acquisition is in the relevant market, that the market is unconcentrated, or that, in any event, the acquisition will not substantially increase concentration.

Although it is difficult to establish "bright line" tests for defining relevant markets, certain characteristics of the relationship between the cities in which the station to be acquired and other holdings of the owner are obviously relevant to such a determination. If the two stations are in the same city they are certainly in the same market. If two stations are widely separated geographically, they are almost certainly not. If they are in adjacent cities, or in cities that are relatively close together, the determination of whether they are in the same market will be difficult. As in the application of the Department of Justice merger guidelines, such factors as (a) evidence that buyers do or do not perceive advertising purchases in the different cities as substitutes, (b) correlations of movements of advertising prices in the cities, and (c) evidence that sellers perceive advertising spots in different cities to be substitutes will be important in determining the appropriate market delineation.[83] Unfortunately, current knowledge about the relationship between group ownership and such variables as advertising rates is based almost entirely on studies that assume, without verification, that the relevant markets are ones defined by the national program rating services, Arbitron and A. C. Nielsen. The Commission will, therefore, be required to conduct analyses that permit it to identify relevant markets for its ownership policies.

If, after conducting its analyses, the Commission were to conclude that existing market definitions are appropriate, its conclusion would indicate that the present group ownership rule does not limit the collective exercise of market power. Even if two groups face one another in several markets, their pricing policies would have to be coordinated separately in each of the markets. Therefore, collusion would appear no easier in these situations than if ownership were limited to a single station.[84] The Commission's rules that prohibit the ownership of two stations in the same service (AM, FM, or TV) in the same market might still be appropriate, although if a local market were unconcen-

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hand, is required to deal with mergers in industries that are highly disparate so that often its analysis must be conducted de novo.

[83]DOJ Merger Guidelines, op. cit., at 637–638.

[84]The results of the Peterman study, indicating that the presence of group owned stations does not raise advertising rates under standard market definitions, would be relevant here.

trated and a particular proposed combination had little effect on concentration, the combination might be permitted.

On the other hand, if the Commission were to conclude that markets were wider than currently defined, it would face the task of establishing whether proposed combinations involving stations in different cities are anticompetitive. It would probably not be wise for the Commission to attempt to produce a list of relevant markets within which combinations are likely to be rejected. Compiling such a list would be an expensive undertaking and might easily become outdated. Moreover, the appropriate definition to employ may depend on the particular combination proposed. Advertising in cities A and C might each be close substitutes for advertising in city B but be weak substitutes for advertising in each other. In some sense A, B, and C form a market, but combinations involving stations in A and B or B and C should receive greater scrutiny than ones involving stations in A and C.

The determination of the relevant market, although it is a challenging task, may, in some cases, turn out to be unnecessary to conduct with great precision. In some circumstances, a finding that two stations are in the same market may produce a market that is so large that it is not concentrated. If, for example, the Commission concludes that Washington and New York are in the same market that market is likely to also include stations in Baltimore, Harrisburg, and Philadelphia. Thus, instead of the market containing only the 19 stations in New York and Washington, there would be 37 stations in the relevant market. Here a combination of stations in the two cities might pose little risk of anticompetitive behavior.

Still another situation in which the precise market definition would be relatively unimportant occurs where, even under the narrowest possible definition, the combined market shares of the station being acquired and the owner's other holdings is very small. Thus, even if Washington and Baltimore are treated as a market, a combination of an independent UHF station in Baltimore and an independent UHF station in Manassas, Virginia, south of Washington, which is in the Washington market as defined by Arbitron, may be of little concern. The Commission might, as the Department of Justice has, publish numerical standards that divide combinations into those that are likely to be found acceptable and those that are not. Thus, the Commission could indicate that it will measure market concentration by the Herfindahl index—the sum of the squares of the market shares of each firm in the market. It could then indicate how large an increase in concen-

tration it would accept as a result of a combination—which would depend, in turn, on the existing level of concentration in the market.[85]

The relevant market for a given station may differ depending on whether its sale of advertising time or its acquisition of programs is involved. Although it is possible that advertising markets are larger than metropolitan areas, program markets are certainly local since stations that serve discrete groups of viewers can purchase the same program without affecting the audience of the other. Thus, a combination of two stations in the same area that might be permitted because the area is part of a larger advertising market and does not substantially increase concentration in that market may, nevertheless, be rejected if the two stations are in the same program market.

This third option is far different from the path the Commission has taken virtually from the beginning of its history. Although the Commission has always indicated that any application might be denied if it led to excessive concentration of ownership, as a practical matter this policy has been enforced through rigid quantitative limitations on station ownership. Indeed, when the *Notice of Proposed Rulemaking* that led to the regional concentration of control rules was adopted in 1975, the Commission stated that the new rules were intended to replace a policy under which

> an applicant seeking to acquire a broadcast station near to, or in the midst of, several of its commonly-owned broadcast stations, is asked to submit a compelling showing disproving the possibility that a grant of its application might result in a regional concentration of control. This process requires an evaluation of a plethora of factors, such as the number of competing media, other signals available, population, areas to be served and distances between stations, which factors have no exact measurable significance, and which tend to give only an apparent precision to our decisions. Dealing with this issue on a case-by-case basis has tended to submerge the Commission's policy in this area.[86]

The Commission indicated that it wished to "move away from its current policy in the area of regional concentration, which requires

[85]One problem that is likely to become increasingly difficult to deal with over time in measuring market concentration is how to take into account alternative methods for distributing television programs, cable, multipoint distribution services, direct broadcast satellites, and others. As these grow in importance, they are likely to constrain the exercise of market power by broadcast stations so that markets that appear concentrated when only broadcasters are taken into account will appear less so when alternative media are considered. Thus, if concentration in the advertising market is of concern, the market shares of existing advertiser-supported cable or direct satellite broadcast services should also be considered in measuring concentration and assessing the effect of a combination in increasing concentration.

[86]54 FCC 2d 331, at 332 (1975).

extensive showings and determinations, toward a policy employing hard-and-fast rules, as is now the case in the other multiple ownership rules."[87]

In short, the Commission expressed its unwillingness to conduct a complete analysis of every case in which the regional concentration of control issue might arise. Although the "plethora of factors" the Commission lists seem significant, the agency was apparently willing to dispense completely with most of them to obtain a rule that could easily be applied. Indeed, one of the reasons given by the Commission for the adoption of a rule was that the previous process imposed large burdens on would-be acquirors.[88] Thus, it appears that one of the Commission's purposes in adopting the rule was to make it *easier* for station combinations to be formed, since many combinations would be permitted under the rule which might be challenged, if not prevented, under the previous policy. Moreover, the Commission's solicitousness toward applicants seems itself a bit misplaced, since the rule presumes that those combinations that violate the rule will not be permitted. In such cases, the cost of the showing is not avoided if a waiver is sought, and if the policy prevents a combination the would-be applicant is clearly worse off.

We do not have in mind a policy like the one the Commission employed before adopting its regional concentration rule. At that time, challenges to combinations were made by outside parties, and the applicant was forced to defend the combination before the Commission. The Commission indicated in its order that most of these challenges were rejected, so that for those combinations permissible under the rule the costs of defending against a challenge would be avoided. The Commission apparently did not play a major role unless such challenges were mounted.

The approach we are suggesting here would be quite different. When station acquisitions are contemplated, the applicant would, of course, notify the Commission. The Commission staff would be required, within a limited period of time, to determine whether or not to challenge the acquisition. If it did not do so this would be prima facie evidence that the transaction was acceptable so that outside challengers would face a heavy burden. On the other hand, rejection by the

[87]Id., at 333.

[88]63 FCC 2d 824, at 826 indicates that the Commission "found that applicants with limited resources were being required to conduct expensive media surveys and submit extensive showings to disprove this regional concentration policy. Our experience has shown that the bulk of these applications raising a regional concentration issue have been granted because our examination of these applications has shown that a regional concentration would not result."

staff would produce either a hearing, if the applicant chose to proceed, or the withdrawal of the application. Over time, as the outlines of the Commission's policy became clear, applicants would be able to determine the likelihood that a particular application would be approved. At the same time, no one would be foreclosed from defending a combination before the staff or the Commission if it felt that the particular circumstances warranted.

Moreover, the approach would not be without standards. Indeed, if the Commission wished, it could issue guidelines for combinations. But these guidelines should be based on analyses that take into account information about concentration in broadcasting and competing media, and should be periodically revised as new knowledge becomes available. At the same time, parties should be permitted to attempt to convince the Commission staff or the Commission, through the administrative process, that a particular combination should be permitted.

The Federal Communication Commission's group ownership rules have correctly been criticized for their arbitrary nature. It is unfortunate, therefore, that the present reconsideration of these rules produced merely an increase in the ceiling on station ownership. At the same time, elimination of all restrictions on combinations of broadcast stations would be unwise. It would be far better if the outcome were an improved understanding of the goals the rules are intended to serve so that rules better suited to achieving these goals might be fashioned.

III. THE REGIONAL CONCENTRATION RULES

Group ownership of broadcast stations increases the likelihood of anticompetitive behavior if (a) the stations are in the same relevant market, e.g., advertisers regard purchases on the two stations as substitutes, (b) the relevant market is concentrated, and (c) the existence of a station group substantially increases concentration in the market. Therefore, a combination of stations in adjacent cities, each of which contains a relatively small number of stations, is more likely to create market power than a combination in widely separated cities, or in cities that contain many other stations or other competing media. The Federal Communication Commission's regional concentration rules were important to the extent that they prevented stations that were not in the same locality, but were in the same market, from operating under common ownership.

These rules have recently been repealed.[1] It is instructive, therefore, to examine the rationale provided by the Commission for the repeal in light of our previous analysis. We conclude that, although the Commission's rules were far from ideal, the Commission's analysis of their effects is not entirely satisfactory. In particular, the Commission's indication that it intends to rely solely on rules regulating ownership within local markets could, in some circumstances, lead to station combinations that are anticompetitive.

The principal reason provided by the Commission for the repeal of its rules is that the "substantial rise in the multiplicity of media voices considerably attenuates both the diversity and economic competition justifications underlying our regulatory limitation of multiple ownership on the regional level.... [T]his growth in media outlets directly diminishes the likelihood that multiple ownership on a regional level might afford licensees sufficient economic power to permit anticompetitive behavior."[2]

Second, the Commission argued that "the rule does not address economic concentration of broadcasting stations in any market relevant to antitrust concerns. Specifically, stations compete with one another for advertising at national and/or local levels. DOJ found that '...advertisers do not generally view the different local markets in a region as good substitutes for each other'.... Similarly, program

[1]Repeal of the "Regional Concentration of Control" Provisions of the Commission's Multiple Ownership Rules, 49 *Federal Register* 19670, May 9, 1984.

[2]Id., at para. 16–17.

acquisition by stations occurs primarily on a national or local basis, making the regional concentration rules unnecessary for ensuring competition in the program acquisition market."[3] For this reason, the Commission argued that its "other multiple ownership rules, particularly its local market restrictions, will continue to restrain group ownership, often more stringently, in many situations that would have been subject to the regional limitations."[4]

Third, the FCC argued that "severely anomalous results" were produced by "the failure of the 'fixed' rules simplistic 'contour overlap' and 'geographic proximity' criteria to consider the number of competing media outlets and the sizes or classes of stations involved."[5] Moreover, the Commission argued that it it was unwilling to return to the previous case-by-case approach to regional concentration because it was "too unpredictable and burdensome,"[6] the reason that it adopted the fixed standard in the first place.

Finally, the Commission argued that its rules "also impose significant costs on the broadcast industry and, ultimately, on the public, which conflict with the rule's underlying purposes of promoting economic competition and diversity of voices."[7] In this connection, the FCC argued that "joint ownership may create operating efficiencies or economies of scale that lower the multiple owner's production costs and thus permit it to channel saved resources into other areas such as programming."[8]

It is hard to disagree with the Commission's conclusion that the arbitrary nature of its rules might well produce anomalous results. In particular, since the rules failed to take into account the number and nature of other media in the region, or the importance of the stations in a regional group, they were just as likely to prevent combinations of small stations in regions with many outlets as combinations of large stations in regions with few alternatives.[9] Nonetheless, the Commission's decision to impose no limitations on regional concentration could produce other anomalies. Thus, under the new policy, a combination of stations in a region with few media alternatives is just as likely to be *permitted* as one where the number of alternatives is

[3]Id., at para. 17.

[4]Id., at para. 20.

[5]Id., at para. 24–25.

[6]Id., at footnote 38.

[7]Id., at para. 27.

[8]Id., at para. 28.

[9]We would note, however, that the similar anomalies can result from the application of the FCC's duopoly and one-to-a-market rules, which the Commission indicates will remain the principal focus of its policy with respect to media concentration.

large. It is in the nature of "fixed" rules that they will produce "anomalies."

What the FCC has done is to assure not that anomalous outcomes will be avoided, but only that they will be of a type different from those that arose under the regional concentration rules. So long as the Commission does not consider combinations case by case, such a result is assured, since the Commission's new policy, like its old one, does not take into account "such factors as the number of competing media outlets and the sizes or classes of stations involved," i.e., it is a "fixed" rule. Moreover, the considerable growth in the number of broadcasting stations and other media outlets upon which the Commission relies heavily may not be relevant to a combination in a region where such growth has not occurred. What is relevant is the extent of competition in the particular region in which a station group operates, not the number of media outlets nationwide.

What about the question of whether stations that are not in the same locality but are in the same region compete with one another? Although it may be true that these stations do not compete in the market for programs, they may compete in the advertising market. Indeed, as we have pointed out above, all of the statistical evidence of the effect of group ownership on advertising rates of which we are aware is derived from studies that *assume* that the market is local. If this assumption is incorrect, and to our knowledge it has not been formally tested, some combinations that are anticompetitive could occur under the Commission's new policy.

With respect to economies of scale that result from the operation of groups, the Commission lists a large number of possible sources of economies. But it does not refer to any evidence that such economies exist, or that they are important. Indeed, although we are cited for the proposition that "in particular situations, substantial gains in economic efficiency might result if groups were permitted to expand beyond current limits" we are also quoted as saying that "the economies to be derived from joint operation are not large."[10] We reiterate here our basic conclusion that the burden remains on those who would argue that scale economies resulting from group ownership are important in a particular case.

To be clear about our conclusions, we are not arguing that the regional concentration rules should have been retained in their previous form. Moreover, even if the rules had not been repealed, station groups would probably not have been handicapped seriously, since they could have purchased stations in other "regions." Perhaps the most

[10]Id., at footnote 41.

serious loss would have been those economic efficiencies that result when stations that are part of the same group operate in the same region. However, no empirical studies shed light on the importance of these economies.

On the other hand, little is likely to be lost as a result of the repeal of the rules, as long as relevant markets are no larger than the markets defined in the FCC's duopoly and one-to-a-market rules. If these market definitions are correct, elimination of the regional concentration rules will have no effect on the ease with which group owned stations can collude or otherwise behave anticompetitively. And, even if the relevant markets *are* larger, no market power will be created in markets where there are many other stations and competing media.

Nonetheless, there may be situations in which group ownership confined to a particular region leads to anticompetitive behavior.[11] We have already suggested the conditions under which such an outcome appears most likely—combinations of stations in geographic proximity to one another with few other media outlets.[12] With the elimination of the regional concentration rule, however, no restrictions remain on such combinations. We would suggest that, rather than simply permit all such combinations, the Commission evaluate them case by case using guidelines similar to those adopted by the Department of Justice for evaluating proposed mergers. Application of this approach, which was discussed in detail in the section on group ownership, is more likely to result in a conclusion that a particular combination should be rejected where the combining stations are in the same region.[13]

The FCC initially adopted its regional concentration rules to avoid the extensive showings and determinations typically involved in its previous case-by-case approach. Nevertheless, we believe that the Commission could employ a case-by-case approach to regional concentration, and to group ownership generally, without the difficulties it faced before the adoption of its rules and, at the same time, avoid the

[11]There may also be situations in which such concentration adversely affects the diversity of viewpoints available to the public.

[12]We re-emphasize that even such combinations will not be anticompetitive if the stations are not in the same relevant market. We regard the question of the extent of the relevant advertising market as an open one, although we can imagine situations in which stations that are in different markets, as traditionally defined, would compete with one another.

[13]However, many combinations that would have been rejected under the Commission's regional concentration rule are likely to be approved under this approach, because they occur in markets that are unconcentrated.

arbitrariness that is generally recognized to have resulted from the applications of these rules.[14]

In our view, the choice is not between "fixed" rules applied arbitrarily and *ad hoc* case-by-case adjudication. The best alternative is, we believe, to attempt to evaluate the particular features of each combination and to do so in a consistent and principled fashion.

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[14]It should be recognized that regional concentration would not be treated as a special problem but rather as part of a general Commission concern with media concentration.

IV. RULES REGULATING LOCAL MARKET CONCENTRATION

We concluded in Sec. II that rules regulating group ownership of geographically dispersed broadcast stations have little support either from available empirical evidence or from economic analysis. In Sec. III, we concluded that a case may exist for regulating regional broadcasting combinations if stations operate in markets that are larger than conventionally defined local markets. An even stronger case may exist for regulating common ownership within local markets, where combinations are more likely to involve competitors. However, the present Commission policies that limit such combinations—the duopoly, one-to-a-market, and broadcast-cable cross-ownership rules—may be too stringent in some circumstances. This section examines the available evidence on the effect of local market concentration and the basis for these rules.

THE DUOPOLY AND ONE-TO-A-MARKET RULES

Because Federal Communications Commission rules have limited, but not prevented, the formation of broadcast groups, one can assess the effects of group ownership by comparing the behavior of group owned and singly owned stations, or the behavior of markets in which such stations are represented to differing degrees. However, the FCC has always prohibited joint ownership of television stations in the *same* market. A similar prohibition applies to FM radio and, since 1941, to AM radio when the FCC adopted its chain broadcasting rules.[1] Thus, one cannot examine the effect of the joint ownership of stations in the same service in a market, because such combinations do not exist.

Nevertheless, a limited basis exists for examining the effects of common ownership of stations in *different* services within a market. Some combinations of television and AM radio stations, which are now prohibited, were grandfathered when the Commission adopted its one-to-a-market rule. Moreover, the one-to-a-market rule permits AM-FM combinations and allows combinations of UHF television stations and FM radio stations case by case. Thus, routinely permitted and grandfathered combinations are potential sources of information about the effect of ownership combinations within a local market.

[1]Before the adoption of the Chain Broadcasting rules by the Commission in 1941, NBC owned two AM radio stations in each of four markets. FCC, Vol. II, op. cit., at 35.

In addition, even in markets without such combinations, the relationship between ownership concentration and economic behavior may shed light on the likely effect of common ownership of stations in the same service. By comparing performances in markets that are concentrated and unconcentrated, one may be able to predict the effect of relaxing or abandoning the duopoly rules. Thus, if markets with many AM radio stations perform no differently from those with few, one may conclude that relaxing the prohibition against joint ownership would not substantially lessen competition. In this section, we attempt to infer, from the limited evidence that is available, the effects of radio-television combinations and of market concentration on broadcast market performance.

Advertising Rates

The Effect of Radio-Television Combinations. Peterman analyzes whether joint ownership of radio and television in a market raises advertising rates. For each market, he assumes that "the proportion of the total number of radio stations jointly owned by TV firms . . . represents the degree of control over radio by TV stations."[2] He relates the average discounted advertising rates summed over all TV stations for each of 204 markets to the number of homes in the market, family income, and the percentage of radio stations owned by TV stations. His analysis shows that, as expected, homes and income are both positively and significantly related to advertising rates. However, he finds no significant effect of cross ownership between radio and television stations. That is, advertising rates do not rise as the number of radio-television combinations increases in a market. Peterman obtains essentially the same result when he limits the analysis to markets with exactly three television stations and to the 51 markets containing only a single station, where cross ownership is measured by a dummy variable equal to one when the lone TV station also operates a radio station.

Unfortunately, Peterman's price data are from station rate cards, and thus do not necessarily reflect transaction prices. Moreover, his model considers only a limited number of factors besides radio-television cross ownership. For example, the analysis involving all 204 markets does not control for the number of television stations in each market. Finally, the variable used to measure joint ownership counts only the number of stations that are involved in combinations and not their importance in the market.

[2]Peterman, op. cit, at 78.

Although Wirth and Allen are concerned primarily with the effects of newspaper-television station cross ownership, they also report findings relevant to the effect of joint ownership of radio and television stations.[3] Using 1973 data for 534 commercial stations, they regress separately television list-price advertising rates and total television station advertising revenues, both per-thousand viewers, against a number of explanatory variables, including whether the station is owned by a newspaper in the same market, the number of households in the station's market, and whether the television station owns a radio station in the same market.

Wirth and Allen find generally positive and occasionally significant relationships between a television station's advertising rate and its joint ownership with a radio station in the market. They interpret this finding as evidence that radio-television combinations create market power. However, their finding is also consistent with the hypothesis that group ownership generates economies that produce larger audiences, and that the relationship between rates and audiences is nonlinear. A test of the market power hypothesis would require examination of whether rates are higher for stations that compete with radio-television combinations because, if such combinations raise advertising rates, all stations in the market should benefit. Unfortunately, Wirth and Allen do not carry out this test.[4]

The Effect of Market Concentration. Fournier and Martin, using transactions price data, examine the effect of market concentration on the price of 30-second television spot advertisements.[5] Controlling for a number of other variables, they employ a number of alternative measures of concentration including entropy—the sum over all stations of market share times the logarithm of (1/market share); the Herfindahl index—the sum of the squared market shares of all stations; and the two-firm concentration ratio.

The coefficients of these measures are either not significant or suggest that rates *fall* with an increase in concentration. The only significant measure is entropy, indicating that advertising rates are *higher* the *less* concentrated is the market. The two-firm concentration ratio, which approaches statistical significance, similarly indicates that the more concentrated is the market the lower are advertising rates.

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[3]M. O. Wirth and B. T. Allen, "Crossmedia Ownership, Regulatory Scrutiny, and Pricing Behavior,"33 *Journal of Economics and Business* 28 (1980)

[4]In examining the effect of combinations of newspapers and television stations, Wirth and Allen do include a variable indicating whether a television station competes with such combinations; id., at 31

[5]Fournier and Martin, op. cit.

However, when the equations were re-estimated treating the two-firm concentration ratio, the Herfindahl index, and the entropy measure as endogenous, none was significantly related to advertising rates. These findings suggest that, at least for the observed levels of market concentration, little or no adverse effect on advertising rates would occur if combinations of television stations were permitted in the *same* market.

Wirth and Bloch present statistical evidence relating the highest 30-second spot rate for a sample of CBS affiliates to, among other variables, the number of households in the station's market, the station's audience share when it carries MASH, and a Herfindahl index for the market based on average daily viewing.[6] They find that market concentration, as measured by the Herfindahl index, is significantly and positively related to advertising rates and conclude, as a result, that television markets are oligopolistic.

Wirth and Bloch also find that audience share is *not* significantly related to advertising rates, a result that is very surprising. A possible explanation of this result, and of the correlation between rates and market concentration, is that a station will have a larger share the more concentrated is its market, i.e., share and the Herfindahl index are correlated. We conjecture that this multicollinearity is affecting their results and, therefore, we are skeptical about their conclusion linking market concentration and advertising rates. However, the Fournier and Martin results could also be affected by multicollinearity, so that their finding that concentration does *not* affect advertising rates may also be a statistical artifact.

Wildman relates the spot television advertising rates of network affiliates and network owned stations to a number of variables including those that measure whether there are more than three VHF stations or more than three stations of any type in the markets of the stations he analyzes. The purpose of including these variables was "to provide a measure of the effect of competition from independent stations on the price of spot time sold by affiliated stations."[7]

Rather than finding the expected negative coefficients for these variables, they are generally positive, although rarely significant, in the different equations Wildman estimates. He interprets these results as evidence that, in markets with more than three stations, the networks are able to get their affiliates to behave like network owned stations because the stations fear the loss of their affiliations. Thus, for the same reason that he argues that spot advertising rates will be higher

[6]M. O. Wirth and H. Bloch, "The Broadcasters: The Future Role of Local Stations and the Three Networks," presented to Columbia University's Conference on "Rivalry Among Video Transmission Media: Assessment and Implications," April 1984.

[7]Wildman, op. cit., at 339.

for network owned stations than for similarly situated affiliates, he contends that rates will be higher for affiliates faced with the possibility that they will be displaced on the network. This reasoning suggests that advertising rates would decline if the number of stations in a market is *reduced.*

Levin also finds that rates are higher if there are four or more stations in a market, even after controlling for station audience.[8] One possible explanation is that this variable, as well as network ownership, is picking up the effect of a misspecified audience variable. If advertising revenues are nonlinearly related to audiences, with rates rising faster than audience, a linear equation will impart a spurious positive coefficient to variables that are present only in the larger markets. This possibility applies to the Wildman study as well.

In their analysis of the determination of television advertising rates, Wirth and Allen include a variable measuring the number of AM radio stations in a market, expecting that "an increase in the number of [radio] competitors in a market leads to lower prices."[9] They find, however, that advertising rates are always *positively* and usually significantly related to the number of radio stations in the market.[10] They attribute this result to the fact that "competitor count variables are seldom exogenous and may reflect market prosperity or market size more than the degree of competition."[11]

In an earlier study, Wirth and Allen analyze market data to determine the effect of local market concentration on advertising rates.[12] They divide FCC advertising revenue data for each of 124 markets by the market's prime time audience to obtain a measure of the "price" of advertising. Among their explanatory variables are the number of television stations and the number of AM radio stations in the market. They conduct separate analyses for different sources of revenues—network, national-regional, and local—and for the top 50 and all other markets, as well as for all 124 markets combined.

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[8]Levin (1980), op. cit., Table, at 153.

[9]Wirth and Allen, op. cit., at 32. Their estimating equation also includes consumer spendable income and the number of households in the market, the station's audience, variables indicating whether the station is part of a television-newspaper combination, operates in the VHF band, is a network affiliate, or competes with a crossmedia combination, the number of newspapers in the market, and a number of dummy variables measuring the market rank.

[10]They do not include the number of television stations, presumably because that variable has already been employed to estimate the share of total market advertising revenues captured by a particular station. Therefore, they do not test the hypothesis that an increase in the number of competing television stations lowers advertising rates.

[11]Wirth and Allen, op. cit., at 35

[12]M. O. Wirth and B. T. Allen, "Another Look at Crossmedia Ownership," *24 Antitrust Bulletin* 87 (1979).

Although the number of television stations usually has the expected (negative) sign, the coefficient is only occasionally significant. The variable for the number of radio stations is negative in only slightly more than half the regressions and significant only when it is *positive*. The results do not, therefore, indicate any strong relationship between market concentration and advertising rates.

Moreover, Wirth and Allen do not really examine advertising rates but rather advertising revenues per thousand viewers. In so doing, they fail to note that these revenues are sensitive to the numbers and types of stations in the market, quite apart from any effect of market structure on competition. Thus, markets with independent television stations will generate different spot advertising revenues than ones with only network affiliates, because much of the time of affiliates is occupied by network programming for which the networks bear all of the costs and keep a portion of the revenues. The measured revenue per thousand viewers will thus be affected by the types of stations that are present in a market. This suggests that Wirth and Allen's findings should be regarded with skepticism.

Syndicated Program Prices

The Network Inquiry Special Staff analyzed the effect of the structure of local broadcast markets on the prices paid by stations for off-network syndicated programming.[13] One set of equations measured competition for syndicated program by the presence or absence of an independent station in a market and whether the independent was "comparable" to the weakest affiliate, i.e., whether it was a VHF station if there were three VHF affiliates or a UHF station if at least one of the affiliates operated on UHF. The study found that "the price paid per viewer is significantly lower [where there is not a 'technically comparable' independent] than where at least one independent is technically comparable."[14] In another set of equations, which also took into account the numbers of various types of independents, "the results clearly indicate that the larger is the number of independent VHF stations in a market, the higher is the price paid per viewer for syndicated programs. The effect of the number of independent UHF stations is mixed, however. In three of the equations, the number of UHF stations in a market is positively and significantly related to the price per viewer. In the other equation, the measured effect is positive but not

[13]FCC, Vol. II, op. cit., at 643–50.

[14]Id., at 647

significant."[15] These results show clearly that the smaller the number of stations competing for syndicated programming the lower the price per viewer obtained for these programs. The effect on the price of the *program* of the number of competing stations is, however, ambiguous. While a larger number of stations may raise the price per viewer, it may also reduce the number of viewers a program attracts.

Diversity

The previous discussion indicates that, in many cases, the *economic* effects of joint media ownership within a local market may not be very great. The results of previous empirical studies suggest that, if preventing anticompetitive behavior were the sole objective of the FCC's ownership restrictions, these rules could often be waived. However, the rules are also intended to prevent concentrated control in the "market for ideas." In this view, important noneconomic objectives may be served by limiting the number of stations in the hands of a single owner. It is argued, for example, that unconcentrated media ownership may lead to more diverse programming, including the provision of more news and public affairs, or to the expression of a wider range of political viewpoints.

Unfortunately, the evidence to support these contentions is virtually nonexistent.[16] We know of no studies that attempt to assess the link between ownership concentration and the diversity of viewpoints expressed. Nor do there appear to be studies that examine the effect of media combinations on the variety of programs available in a market. Indeed, theory suggests that such combinations may actually increase variety.[17] Without such evidence, claims that the rules limiting local market ownership combinations will lead to increased diversity are simply unsupported assertions.

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[15]Id., at 650.

[16]An amusing exchange occurred at the conference at which this paper was discussed. Advocates of the view that diversity of ownership leads to diversity of programming or viewpoints could provide no support for their view, but those who argued that ownership combinations create operating efficiencies similarly could point to no evidence for that view. Both positions remain largely articles of faith.

[17]See, P. O. Steiner, "Program Patterns and Preferences, and the Workability of Competition in Radio Broadcasting," 66 *Quarterly Journal of Economics* 194 (1952).

Conclusions

As in the case of multiple station ownership, the empirical studies do not provide convincing evidence of adverse effects of local market concentration. The only evidence that joint ownership creates market power is Wirth and Allen's finding that television stations jointly owned with radio stations in the same market have higher advertising rates than do stations not under common ownership. However, this result, which contrasts with Peterman's finding that the presence of radio-television combinations in a market does not affect rates, is consistent with other hypotheses. For example, it may reflect economies of joint operation that produce larger audiences, combined with a willingness on the part of advertisers to pay more per viewer for larger audiences. Moreover, because the effect of these combinations on the rates of other stations was not examined, the market power hypothesis has not been fully tested. The various studies of the effect of concentrated television station ownership on advertising rates indicate that there is no effect—or that rates are higher the *less* concentrated is the market. Finally, none of the studies demonstrates the existence of significant economies of joint operation nor is there any evidence of the effects of concentrated ownership on diversity.

Nonetheless, we would be reluctant to urge abandonment of the duopoly and one-to-a-market rules with nothing to take their place, because the analytic case for these rules is far stronger than that for the group ownership rule. This does not mean, however, that present restrictions are ideal. Rather, we believe that, as a substitute, the case-by-case approach we discussed with respect to group ownership would be appropriate here as well. The major difference is that more group acquisitions in different cities or metropolitan areas would likely be approved than would new combinations in the same city.

Here, establishing that proposed station combinations are in the same market should be straightforward, although it might be argued in some cases that particular radio and television stations are in different markets. Consequently, no combinations of local stations would be approved on the grounds that they are in different markets. The effect of the combination on concentration would, therefore, have to be confronted in every case. Many local markets are sufficiently concentrated that proposed combinations in them would be denied. But some markets are presently quite unconcentrated, so that even combinations of stations in the same service in these markets would probably not create market power. For example, the FCC might well approve a combination of two AM radio stations in the Los Angeles market, where

there are presently more than three dozen radio stations, under the case-by-case approach we suggest.

THE BROADCAST TELEVISION-CABLE CROSS OWNERSHIP RULE[18]

When the Federal Communications Commission banned combinations of television stations and cable systems in the same market in 1970, it did so out of fear that common ownership would be used by station owners to inhibit the growth of cable. Reduced cable signal quality, relatively high monthly rates to subscribers, and carriage of fewer or less popular distant signals were among the possible strategies thought to be available to a station owner. Conversely, if the owner believed the opportunities for additional profits in cable to be greater than those in broadcasting, over-the-air service might be permitted to deteriorate to favor cable growth. As Barnett expresses it,

> Either way, existence of the television-cable duopoly would tend to impair the television service available to the public. The public would be better served with two outlets striving competitively to maximize their respective audiences.[19]

With the ban on broadcast television-cable cross ownership having been in effect for more than a decade, and with few combinations grandfathered, only limited data are available for empirical analysis. Consequently, we draw on a priori analysis, supplemented by assessment of two relevant empirical studies.

The Benefits of Joint Ownership

There appear to be only very limited benefits to relaxing or abolishing the rule. Local broadcasters have no particular expertise in coping with many facets of cable operation—negotiating with telephone companies for pole attachments; designing, building, and maintaining trunk and drop lines; marketing cable services; handling customer complaints; and dealing with local franchise authorities. Similarly, cable operators are not experienced in building and maintaining over-the-air transmitters or complying with FCC broadcasting regulations.

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[18]Much of the analysis in this section can be applied to combinations of broadcast stations and multipoint distribution systems (MDS). The principal difference between MDS and cable is that, because of the latter's much larger channel capacity, subscribers are likely to obtain all of their television service over the cable, whereas households taking MDS will continue to view over-the-air signals.

[19]S. R. Barnett, "Cable Television and Media Concentration, Part I: Control of Cable Systems by Local Broadcasters," 22 *Stanford Law Review* 221 (1970), at 299.

However in two areas—program origination and advertising—the same functions are carried out by both broadcast stations and cable systems. Economies might, therefore, result from sharing studio space and equipment for broadcasting and cable program origination, as well as from the use of personnel to acquire programs and sell advertising for both the cable system and the broadcast station. However, to our knowledge, no studies have addressed the magnitude of the possible savings from combining these operations. It would be useful to analyze the costs that cable systems incur in program origination; the extent to which these costs would be reduced by sharing broadcast station facilities; the additional costs that the station would incur in providing these services; and the costs of linking the broadcast station and the cable headend.

For three reasons, we conjecture that the net savings of shared use would be low. First, cable program origination facilities, consisting largely of character generators, automated services, and relatively cheap cameras and other studio equipment, generally do not involve large costs. Second, a broadcast station would have to incur at least some of these costs if it took over these functions. Third, if potential cost savings were substantial, one would have expected to see instances where separately owned cable systems and broadcasting stations entered into shared-use or rental agreements to their mutual benefit. However, such arrangements apparently are rare.[20]

With the growing sales of advertising by cable operators, one might expect that economies would also flow from joint ownership.[21] However, the strategy of selling advertising for the small audiences that view advertiser-supported cable channels varies from that of selling for the entire audience within the service area of a broadcasting station. Moreover, media conglomerates, with holdings in both cable and broadcasting, may be able to exploit at least some economies, even though they cannot hold more than one such property in a single market.[22]

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[20]The research department of the National Cable Television Association reports that, to its knowledge, only two or three instances have arisen of cooperative arrangements. No formal survey of such practices has ever been undertaken. One reason for the absence of these arrangements may be that cable systems are required, as a condition of obtaining a franchise, to make extensive studio facilities available for public access, and cannot satisfy that condition by leasing facilities from others. If a cable system that is jointly owned with a local broadcast station can fulfill this obligation by providing access to the station's studio facilities, costs can be reduced.

[21]The fact that most advertising sales on cable are made at the network level, i.e., by the providers of program services, limits these economies. The economies of joint marketing activities would be increased if there were a strong national spot market for advertising on cable.

[22]Some economies in local advertising sales might be possible without joint ownership if, for example, a broadcaster contracted to sell advertising on behalf of a cable system in the same market. Instances of such behavior are rare or nonexistent, however.

The Losses from Joint Ownership

Nonetheless, we see little to be lost by relaxing or eliminating the rule, at least in large markets. It is unlikely that a broadcaster will choose to inhibit the growth of his cable system (or for a cable owner to behave similarly toward his broadcast station).[23] To pursue this strategy the broadcaster would have to forgo the benefits that result when cable extends his signal to additional audiences. More important, the gains from weakening the service provided by the cable system would be shared with competing broadcasters.[24]

In theory, the owner of a cable system that is owned jointly with a local broadcast station will have different incentives than would a cable system owner with no such link. Thus, for example, in determining whether or not to offer an additional service on the cable system, the owner of a television-cable combination will take into account any diversion of revenues from its broadcast station. However, the larger is the number of broadcast stations, or other competing media, in the market the less important will be this diversion, since most of the audience for the new service will come from other stations. Thus, we would expect that in markets with many stations there will be little difference between the behavior of cable systems that are jointly owned with television stations and those that are not.

But what about diversity? Would not common ownership reduce the number of "voices" in the market, contrary to the Federal Communication Commission's often stated goal? We think that this danger is exaggerated. With its multiple channels, cable surely brings many voices into the market. But, to what extent does cable ownership *itself* make a difference? Unless ownership by a broadcaster would lead to a more restricted menu—and our preceding argument suggests that it would not—there is little to fear.[25]

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[23]However, Thorpe finds a small but statistically significant effect of the presence of an STV station on the market power of a cable system. See K. Thorpe, "The Impact of Competing Technologies on Cable Television," presented to Columbia University's Conference on "Rivalry Among Video Transmission Media: Assessment and Implications," April 1984.

[24]This assumes that cable carriage of all local signals will continue to be mandated by the FCC. Hence a broadcast-owned cable system could not discriminate against other local broadcasters. Robert Pepper points out, however, that the elimination of the must-carry rule would be made more difficult if the ban on cross ownership were removed.

[25]It is a separate question whether requiring cable operators to carry programming provided by others will improve the fare available to viewers. We consider this question in detail in S. M. Besen and L. L. Johnson, *An Economic Analysis of Mandatory Leased Channel Access to Cable Television*, The Rand Corporation, R-2989-MF, December 1982, and conclude that the effects of mandatory leased channel access on viewers are ambiguous.

One would have more reason for concern if cable owners were editorializing and in other ways expressing their own views to any notable degree. In this case, common ownership with a broadcast station might mute this voice (or mute the voice of the station). But one is hard pressed to identify cases where cable operators are doing this, as against carrying the voices of others.

Of course, one might argue that as cable further develops, their owners will increasingly perform this function. But competing media will also develop so that, in any event, diversity will likely continue to expand.

The Empirical Evidence

Consistent with the above reasoning, two empirical studies of the cross ownership ban suggest no striking differences between the behavior of combinations and independently owned outlets. The first study, by Miller, uses regression analysis to compare the behavior of 47 cross-owned cable systems with a random sample of 106 systems from the approximately 4000 independently owned systems.[26] Miller considers separately two dependent variables—total television broadcast signals carried and total optional broadcast television signals carried—regressed on four independent variables—the number of subscribers, whether the system was cross-owned, whether the system was owned in combination with other cable systems, and the age of the system.

In both large and small markets, Miller shows that cross-owned systems carry fewer television broadcast signals than do independently owned systems. However, only in markets below the 100 largest is the relationship statistically significant.[27] Moreover, the number of signals subject to the FCC's mandatory carriage requirement is higher for Miller's sample of independently owned systems than is the case for the 47 cross-owned systems (5.09 signals vs. 4.50 signals). He notes that the effects of mandatory carriage account for at least some difference in the regression results.

The pattern with respect to optional signals carried from television stations is less consistent. Cross-owned systems in the largest 50 markets carry fewer such signals than do independently owned systems, but the reverse is true in the second 50 markets. In smaller markets, cross-owned systems carry fewer optional signals, but the

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[26]James C. Miller III, affidavit, Appendix A, in *Petition for Deletion of Section 76.501*, Kirkland and Ellis, Washington, D.C., filed with the FCC, November 24, 1980.

[27]The t-statistic for these "smaller" markets is −2.51, in comparison with a statistic of −1.60 and −0.21 for the top 50 and the second 50 markets, respectively.

relationships are not statistically significant. In other regressions, Miller considers four other dependent variables—number of pay cable channels, number of automated channels, number of public access channels, and number of "other origination" channels. Cross-owned stations carry 0.204 fewer pay channels but 0.518 more automated channels, while the relationships involving public access and other origination channels are statistically insignificant.

Finally, Miller tests the Commission's hypothesis that cross-ownership leads to especially undesirable behavior in "egregious" cases where the number of independently owned media outlets is small. There, cross-owned cable systems carry fewer total television signals, but more optional signals, from television broadcasting stations. However, neither result is statistically significant.

On balance, Miller's study suggests that undesirable behavior of cross-owned systems is most likely to occur in smaller markets, as evidenced by the statistically significant negative relationship between cross-ownership and total television broadcast signals carried and the negative, though statistically insignificant, relationship between cross-ownership and the total number of television signals carried.

Unfortunately, Miller does not include in his regression analysis two potentially important independent variables—the number of homes passed per mile of cable, and whether the cross-owned cable system operates in combination with either a VHF or a UHF station. Controlling for subscriber density, which affects the per-subscriber cost of cable services, might help to clarify relationships between ownership status and behavior in the regression analysis. Moreover, cable systems co-owned with UHF stations may behave differently from those co-owned with VHF stations. Miller argues that while the Commission assumes a competitive relationship between broadcast and cable television, it "is arguably just as plausible, however, to assume that on the whole the two services are *complements.*"[28] A complementary relationship, where cable benefits the broadcast station by enhancing the quality and extending the range of its signal, is more likely to arise for a UHF station than for a VHF station. But we cannot determine whether this is the case from Miller's analysis.

A second study of cross ownership was submitted to the FCC in 1981 by the Chronicle Publishing Company.[29] It compares the behavior of 48 cross-owned cable systems with 81 divested systems and with the "universe" of all cable systems in the nation. The study is

[28]Id, at 7. Emphasis in the original.

[29]*Exhibits Submitted with the Comments of the Chronicle Publishing Co.*, FCC Docket No. 20433, January 8, 1981.

limited to cross-tabulations, rather than using regression analysis that permits one to control for other factors in examining the relationship in question.

The tabulations show that the average basic subscriber rates are about the same across the three categories. But the monthly charge for pay channels is higher for cross-owned systems ($9.56 on average compared to $8.73 for divested systems and $8.44 for the others). The average level of pay penetration (the number of pay subscribers as a percentage of total subscribers) is also lower for cross-owned systems—36 percent compared to 41 percent for both of the other groups. When the data are categorized by size of cable systems, the study shows that "some slight changes occur in their relationships, but nothing very substantive arises."[30]

From other tabulations, the authors conclude that "cross-owned cable systems offer, on the average, a comparable or greater number of non-broadcast programming services than do the average divested cable systems,"[31] and that "there is no significant difference" in the total number of broadcast signals carried by the two groups.[32] They also conclude that "there seems to be no significant difference, on the average, in the degree to which cross-owners and divested system owners have developed their respective cable systems in terms of access to studio and local origination facilities or in local services offered."[33]

The methodology of this study is too weak to be useful. It does not test for statistical significance for the differences it asserts to be "significant" or "insignificant." And, like Miller's study, it fails to account for the potentially important factors of subscriber density, and co-ownership with either a VHF or UHF station.

Conclusions

The problem posed by cross ownership, if it exists, is most likely to occur in small markets. Here, the owner might reduce the quality of his broadcast signal, especially if he has the only station in the market. By transmitting a weaker signal than allowed by the FCC, and by carrying less attractive programming than would a separately owned station, he may gain more from increased cable penetration than would be lost from the smaller over-the-air audience. Moreover, the jointly owned system might be able to exercise market power against advertisers and program suppliers.

[30]Id., at 13.

[31]Id., at 22.

[32]Id., at 20.

[33]Id., at 23.

Thus, while the FCC would be unwise to abandon the broadcast-cable cross ownership rule in one-station markets, situations exist in which joint ownership may produce operating economies without creating market power. Thus, a modified rule might stipulate that joint ownership would be permitted (a) if the market contains no fewer than a specified number of stations, or (b) if the jointly owned station has a market share no greater than a specified maximum, or (c) if the station is a UHF in a mixed market.

Even better, we believe, would be the case-by-case approach discussed earlier. This more flexible approach would facilitate accounting for the growing competition from other media and the additional diversity of viewpoints that they provide.

V. TELEPHONE-CABLE TELEVISION CROSS OWNERSHIP

Except in rural areas with low population density, the FCC generally prohibits telephone companies from owning and operating cable television systems in their service areas. The ban, adopted in 1970, was triggered largely by the Commission's view that "the public interest . . . will best be served, at this time, by preserving . . . a competitive environment for the development and use of broadband cable facilities and services . . . [and] that preservation of such competition will best be assured by the exclusion of telephone companies in their service areas from engaging in the sale of CATV service to the public except where no practical alternative exists. . . ."[1] Among the Commission's concerns was that telephone companies would use revenues from their other services to subsidize the construction and operation of cable systems as a tactic to exclude potential competitors for cable franchises.[2]

The ban on telephone-cable television cross ownership is currently attracting interest because technological advances, especially in fiber optics, are blurring the distinction between the switched narrowband services of telephone companies and the unswitched broadband services of cable systems.[3] Consequently, whether continuation of the ban promotes the public interest in terms of economic efficiency and competition remains an open question.

As in the case of the FCC's duopoly and television broadcast station-cable cross ownership rules, no studies of the comparative behavior of separately owned and jointly owned telephone and cable systems are available, because few jointly owned systems exist. Moreover, the experience with such systems, concentrated in rural areas where independent cable systems would likely not develop, sheds little light on the effects of the ban in metropolitan areas where policy attention is now focused. Consequently, we must rely on theoretical

[1]21 FCC 2d 307 (1970), at 325.

[2]The Commission was also concerned that telephone companies could discriminate against independent cable companies in providing access to telephone poles and conduits. However, legislative action has given the FCC authority to regulate pole attachments where the states do not do so. The severity of this problem is therefore reduced. See FCC, *Staff Report on Cable TV Crossownership Policies* (November 1981), at 141–2, 154, 162.

[3]The United States Independent Telephone Association petitioned the FCC in November 1982 to repeal the cross-ownership ban. At this writing, the Commission has not acted.

analysis, supplemented by other scattered evidence drawn from the evolving nature of the two industries.

Our purpose here is to assess the merits of retaining or abolishing the cross-ownership rule in light of ways in which the industries may be expected to develop. To do so, we outline briefly the evolution of the cable industry and treat the key aspects of the ban. Second, we assess the merits of changing the rule in light of ways that the industries may be affected by technological change. Third, we assess possibilities for relaxing the ban, depending on the characteristics of individual markets.

THE EVOLUTION OF THE CABLE INDUSTRY

Telephone companies rely on switched networks to provide voice and data communications. Telephone networks are configured as "stars," with each user being connected to every other user, so that two-way switched services can be provided. Broadband video services provided by telephone companies consist primarily of nonswitched links to television broadcasting studios, remote television feeds, and videoconferencing facilities.

By contrast, dating from the early days of "community antenna television" in the late 1940s, cable companies have used "tree-and-branch" networks of coaxial cable to provide unswitched one-way distribution of broadband services from a "headend" to dispersed residential and business locations. Some systems now have a two-way capability, with upstream channels for voice and data. These systems can collect information from subscribers for transmission to the headend, to permit services such as "pay per view" and consumer polling. However, systems that permit subscribers to communicate directly with one another are virtually nonexistent at present.

Telephone and cable companies share conduits and street poles for carrying their wires. However, the technical requirements for full two-way narrowband communications and for basically one-way broadband service to residences, combined with very high reliability demanded for telephone service, have reduced the economic attractiveness of combining the two services into a single system.

Nevertheless, in some cases, especially in rural areas, the use of common maintenance crews and the simultaneous construction of narrowband and broadband facilities can reduce costs. For this reason, the Federal Communications Commission permits cross ownership in rural areas with low population density (generally with fewer than 30

homes per cable-line mile) to encourage the growth of cable television in places where it otherwise might not exist.[4]

Moreover, the Commission permits telephone companies to *build* cable systems in more densely populated areas if they are leased to independent cable operators who *operate* the systems. However, such leaseback arrangements are not common. One study reports that in 1981 only a dozen telephone companies posted leaseback tariffs.[5]

Even without cross ownership, one would expect cooperative arrangements between telephone and cable companies for maintenance crews and construction, as well as numerous leaseback systems, if substantial economies were achievable. The fact that such activities are rare suggests that the potential economies have been small.

KEY ASPECTS OF THE BAN

Of course, the merits of the cross-ownership ban hinge critically on what it does and does not prohibit. A key provision of the ban stipulates that "No telephone common carrier, subject in whole or in part to the Communications Act of 1934, shall engage in the furnishing of cable television service to the viewing public in its telephone service area, either directly, or indirectly. . . ."[6]

However, the ban covers only systems that retransmit the signals of broadcast stations, because "cable television" is defined as "A nonbroadcast facility consisting of a set of transmission paths and associated signal generation, reception, and control equipment, under common ownership and control, that distributes or is designed to distribute to subscribers the signals of one or more television broadcast stations. . . ."[7] As one analyst observes:

> No present FCC rule, therefore, restricts telephone companies from providing the nonretransmission video or nonvideo portions of cable television service, such as pay TV, videotext, home shopping, electronic mail and banking, energy management and security systems.[8]

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[4]The evolution of the FCC's decisions about common ownership in rural areas, and its waiver policies more generally, are contained in 21 FCC 2d 307(1970), 81 FCC 2d 233 (1979), 82 FCC 2d 254 (1980), 84 FCC 2d 335 (1981), and 88 FCC 2d 564 (1981).

[5]FCC, *Staff Report*, op. cit., at 143. However, leaseback arrangements may becoming more popular. One study reports several cases of leaseback arrangements, including one for the City of Palo Alto, California, which we discuss below. See W. S. Baer, "Telephone and Cable Companies: Rivals or Partners in Video Distribution?" presented to the Columbia University Conference on "Rivalry Among Video Transmission Media," April 1984.

[6]47 CFR Sec. 63.54(a) (1982)

[7]47 U.S.C. Sec. 76.5(a).

[8]Frank W. Lloyd, "Cable Television's Emerging Two-Way Services: A Dilemma for Federal and State Regulators," 36 *Vanderbilt Law Review* 1045 (1983) at 1083. Lloyd

Thus, a telephone company would be free to build a cable system and, so long as it did not retransmit broadcast signals, it could offer other services that cable television firms offer today.[9]

However, limitations on these other services are imposed on the divested Bell Operating Companies (BOCs)[10] by the Modification of Final Judgment (MFJ) in the settlement of the Department of Justice's antitrust suit against AT&T.[11] The MFJ "restricts Bell Operating Companies to the provision of common carrier local exchange services and specifically prohibits them from offering electronic information services."[12] However, so long as they are offered on a tariffed common carrier basis, other services (such as pay TV) could, presumably, be offered by the BOCs.[13]

Telephone companies have expressed little interest in directly providing pay television and other broadband services to residential subscribers because (a) the switched networks they employ are not suited to this task, and (b) the market for such services might not be attractive if retransmitted broadcast signals are not included. These considerations raise questions of "economies of scope" and "economies of scale," to which we now turn.

ECONOMIES OF SCOPE AND ECONOMIES OF SCALE

The virtually complete separation in the past of telephone and cable system construction and operation suggests that the "economies of scope" are small. That is, the total cost incurred by a firm to offer

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notes that "this limitation [with respect to broadcast signal retransmission] resulted from the Fifth Circuit's interpretation of the FCC's limited jurisdiction to regulate cable as ancillary to broadcasting. See General Tel. Co. of the Southwest, 449 F. 2d 846, 859 (5th Cir. 1971)."

[9]It should be noted that, for purposes of the rule, "cable television" includes non-cable systems such as MDS, if they are used to retransmit broadcast station signals.

[10]The BOCs serve about 48 percent of the geographical area, but about 81 percent of the telephones, of the United States.

[11]*United States v. AT&T Co.*, 552 F. Supp. 131, 231 (1982)(Opinion and Order Modifying Final Judgment), aff'd mem, sub. nom. *Maryland v. United States*, 51 U.S.L.W. 3632 (February 28, 1983).

[12]Lloyd, op. cit. See also the study of competition in local markets by R. Pepper, *Competition in Local Distribution: The Cable Television Industry*, Program on Information Resources Policy, Harvard University, Cambridge, 1983.

[13]Moreover, entry into other markets is permitted "upon a showing by the petitioning BOC that there is no substantial possibility that it could use its monopoly power to impede competition in the market it seeks to enter," *United States v. AT&T*, op. cit., p. 231.

together given quantities of telephone and television services is little different from, or may be greater than, the total of the individual costs incurred by two firms, one supplying only telephone service and the other supplying only noninteractive television service.

For expository convenience, we shall define "telephone" service as encompassing residential narrowband and business narrowband and broadband communications, and "television" as encompassing one-way residential broadband communications. Thus, we consider as telephone services the interactive services (such as burglar and fire alarms) that some cable systems offer to residential subscribers because they are close substitutes for conventional telephone system offerings.

For the subsequent analysis, it is important to distinguish between economies of scope and economies of scale. Economies of scale arise from "transmission economies" or from the spreading of "fixed" costs elsewhere in the system. Transmission economies arise when the average per-subscriber cost falls as additional subscribers are connected to a transmission line—such as coaxial or fiber optic. The extent to which this cost falls depends on the cost of the line relative to other costs of connecting additional subscribers to it.

To illustrate, consider two extreme cases. In the first, the line cost is positive whereas the cost of adding subscribers to it is zero. In this case, per-subscriber cost falls as additional subscribers are added, because the transmission cost is spread over a larger subscriber base. In the second case, the transmission line cost is zero whereas the cost of connecting each subscriber is positive because, for example, electronic equipment is required at each subscriber's premises. Here, transmission economies are zero, since average cost—equal to the cost of the equipment on the customer's premises—is constant.

In addition to transmission economies, economies of scale may arise, for example, when cable headend costs or telephone central office overhead costs are spread over a larger subscriber base, which causes per-subscriber cost to fall. Such scale economies affect the optimal size of the telephone or cable system. For example, if cable headend costs are high, the optimal size of cable systems, measured by number of subscribers served, would be relatively large.

The common belief that it is wasteful for two or more firms to run parallel lines down city streets is predicated on the notion that transmission economies are positive. The weak economies of scope in combining telephone and television services, noted above, combined with strong scale economies, provide the basis for the common belief that telephone companies and cable systems can operate efficiently side by side as natural monopolies. But other combinations are possible. If both scope economies and scale economies were strong, a single firm

could offer both services as a natural monopoly. If both scope economies and scale economies were weak, multiple firms would compete in separately providing telephone and television services. If scope economies were strong and scale economies were weak, multiple firms could compete in supplying combinations of telephone and television service.

These various combinations are important to keep in mind, because technological advances may affect both scope and transmission economies, and hence the optimal market structure for telephone and television service. In particular, opportunities are increasing for cable systems to offer narrowband and broadband services in competition with local telephone companies.

Among the many examples, GTE has announced a pilot program linking facilities in New York with Viacom's cable system in San Francisco, with the long distance portion to be handled by GTE Sprint.[14] MCI has tested its "Cablephone" service with Cox Cable Communications in Omaha, and has announced plans for residential use, linked to MCI's long distance service. In Prince George's County, Maryland, bidders for a cable franchise have been required to offer a switched network for telephone, teleconferencing, facsimile, and data services for public institutions and government agencies in the county.

In addition to cable, other technologies are being used to bypass local telephone networks. Terrestrial microwave facilities, satellite links, and cellular radio systems are notable examples.

One cannot predict the extent to which bypass of local telephone networks will continue to grow. However, the issue of bypass by cable and other means is currently a subject of heated debate in Congress and elsewhere because of its implications for restructuring local telephone rates, especially with respect to access charges that the FCC plans to impose on business and residential subscribers.[15] Such developments raise many issues about the wisdom of maintaining the cross-ownership ban—a topic to which we now turn.

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[14]The information in this section on competitive services offered by cable systems is drawn from "Response of American Telephone and Telegraph Company to the Commission's Request for Bypass Information," May 21, 1984, at 18–19. See also Pepper, op. cit.

[15]For accounts of the controversy about the FCC's moves to impose end-user charges for access to the telephone system, see *Telecommunication Reports*, December 26, 1983, at 1–4, and February 13, 1984, at 1–2.

SHOULD THE BAN BE LIFTED?

We see two dangers in lifting the ban: cost shifting as a way to evade rate of return regulation, and an increase in market power. With respect to the first, a regulated telephone company may have an incentive to acquire an unregulated cable system as a way to increase its profits. If it could shift costs from its unregulated services to its regulated services, costs could be recovered by increases in telephone rates, while profits in the unregulated market would rise because of the reduction in costs attributed to that market.[16] With respect to the second danger, elimination of the ban might increase the market power of the firm owning two systems that would otherwise compete with each other, depending on the extent to which potential customers could use microwave radio, satellite links, cellular radio, and other technologies to bypass both telephone and cable facilities.

How easily could a telephone company engage in cost shifting and increase its market power if the ban were lifted? To answer this question, we consider four cases with varying combinations of scale and scope economies.

Case 1: Weak Economies of Scope; Strong Economies of Scale. This is the situation that has characterized the two industries until recent years. Telephone and cable systems have developed side by side with few shared facilities and noncompeting services. In this case, neither the benefits nor the costs of the cross-ownership ban are large. Whether the ban is retained or abolished would have little affect on society. Facilities for telephone and television services could remain separately owned without economic loss, with sharing limited to poles and conduits. Thus, retention of the ban would not reduce economic efficiency.

At the same time, repeal of the ban need not raise serious dangers of cost shifting or of increased market power. The telephone system would be treated as a common carrier, with its accounts kept in conformity with state public utility and FCC requirements. As with any regulated carrier, the system would be permitted to set rates with the objective of earning a "fair return" on its investment. The cable system, presumably, would be operated by a separate subsidiary operating under local or state franchise agreements, or possibly regulated also as a common carrier.[17] Separate cost and revenue accounts for each

[16]The possibility of cost shifting is explored in greater detail in FCC, *Staff Report*, op. cit., at 154–57.

[17]A major current issue is whether cable companies that offer services competitive with those of telephone companies should be treated as common carriers. See, for example, Lloyd, op. cit., who argues against common-carrier regulation of cable.

system would suffice to prevent the telephone company from shifting costs from cable to telephone operations.[18]

We must emphasize that the separation of facilities is the key to using an accounting approach successfully to protect against the danger of cost shifting. The inadequacies of the accounting approach when multiple services are offered on *common* facilities are well illustrated by the long history of the FCC's attempts to determine whether AT&T's rates have been just and reasonable for a variety of message toll, WATS, and private line services, all of which employ the interstate long distance network. If, however, there are no economies of scope between cable and telephone services, the problem of separating costs should not arise.

Under the assumptions of this case, moreover, there would be little danger of increased market power. With weak economies of scope between telephone and television service, i.e., few economies afforded by combining residential broadband service with either residential narrowband or business broadband and narrowband services, telephone companies and cable systems would continue to offer noncompeting services.

To be sure, cable systems would continue to compete with alternative television delivery systems such as MDS, STV, and DBS. Is it not possible that the telephone company could use profits from its monopoly services to subsidize its cable television service as a way to drive out or discourage entry by firms with alternative television delivery systems? This danger would not arise so long as cost shifting does not occur, since it is only by that means that cross-subsidization could be accomplished. If telephone and television services are offered on separate facilities, it might be possible to protect against such behavior.

Case 2: Moderate Economies of Scope; Strong Economies of Scale. A variant of Case 1 involves economies of scope sufficient to encourage limited competition between telephone and cable companies. In contrast to Case 1, where weak scope economies exist between telephone and television service, here cable companies can economically combine television with interactive nonswitched services. As a result, they are able to compete with telephone companies in offering services such as data transmission and security systems. However, economies of scope do not extend to combining television service and conventional residential telephone service. Hence, no economies arise from combining all services to the home on one facility. This case resembles the way that

[18]The sharing of poles and conduits would pose problems of allocating costs between telephone and cable systems. But these allocations, being a small part of total cost, raise less severe problems than would be the case with shared use of transmission links, amplifiers, and other electronic equipment.

industry appears to be evolving. In this situation, continuation of the cross-ownership ban is merited insofar as it encourages continued competition between the two entities.

Case 3: Strong Economies of Scope; Strong Economies of Scale. Here, a single firm could offer both television and telephone services over integrated facilities at a lower cost than the combined cost incurred by two separate firms, each offering only one form of service. Moreover, with strong economies of scale the firm would operate as a natural monopoly.[19] The "single wire" into the home and business, combining the whole range of broadband and narrowband services, is an illustration of this case.

The possibility of this outcome is attracting increasing attention because of the development and commercialization of fiber optics. Not only does a fiber optic strand have sufficient capacity to accommodate both narrowband and broadband communications, but its small cross section and its immunity to electrical interference facilitates installation, particularly in crowded underground ducts. For these reasons, both telephone and cable companies are beginning to install fiber optics for trunking.

Moreover, experiments are underway, especially outside the United States, in which fiber optics are substituted for conventional "local loop" telephone wires and for coaxial cable television "drop lines" to the subscribers' premises. Successful applications would permit a range of narrowband and broadband services to be carried on one or a few glass strands.[20]

Thus, telephone companies could offer a more extensive range of broadband services to business customers and, perhaps, television to residential customers along with traditional telephone service. Existing cable operators would also have greater opportunities to offer both broadband and narrowband services, initially on an unswitched basis. Later, switched services could be added to the extent that cable systems find it economically feasible to reconfigure their networks and to install switching equipment.

Such developments, presumably, are what former FCC Commissioner Fogarty has in mind in arguing that:

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[19]Of course, the extent to which the firm would have market power would depend on the degree to which other systems such as MDS and DBS offer competitive services.

[20]Examples of these activities and references to the literature are included in FCC, *Staff*, op. cit., at 152, and in Commissioner Fogarty's comments on the report, at 6. For a survey of current and prospective technological developments, see Baer, op. cit.

> The Commission must . . . confront the possibility that the prospect of merging fiber optic technology with the local loop of the telephone exchange may offer "natural monopoly" economies in the provision of broadband facilities and services which a sound and rational policy analysis cannot ignore. If these economies emerge in significant magnitude, then telephone company competition in the cable television marketplace may be "unfair" only in the sense that it may be inherently unbeatable. If this should prove to be the case, the hard but necessary answer may have to be that the public interest is better served by such unfairness.[21]

Following this point of view, consider the possible effects of lifting the ban. The telephone company would be free to offer retransmission of broadcast signals, along with other television services (presumably on a common carrier basis) in competition with one or more cable companies operating within its service area. With strong enough scope and scale economies, one firm, either the telephone company or a cable system, would eventually survive in each local service area. However, if the cross-ownership ban were lifted immediately, the possibility that the telephone companies will cross-subsidize those services in which they compete with cable could distort the resulting outcome.

In dealing with the ownership rules in the preceding sections, we concluded that cross-subsidization was an unlikely strategy for firms whose profits are unregulated. However, a firm facing a binding constraint on its rate of return may not experience a reduction in its profits if it sets prices below its incremental cost in markets in which it faces competition, if it can increase rates in its regulated markets through cost shifting as discussed earlier. A telephone company may find this strategy attractive as a way to discourage competition from both independently owned cable systems and from firms offering television using MDS, DBS, and other means. Thus, a telephone company may have an advantage over competing applicants in bidding for a franchise, with the additional costs of doing so compensated by higher rates for telephone service. Similarly, it may be able to outbid others in purchasing existing cable systems.

Moreover, regulation of the cable television portion as a common carrier would not eliminate this problem. The telephone company might still have incentives to set relatively low television rates to drive out (or to acquire) existing cable systems and to compete with MDS and other forms of delivering television, with the cost burden shifted to its telephone services.[22]

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[21]82 FCC 2d 266, 273.

[22]As discussed earlier, concerns about possible predation by AT&T in long-distance markets during the 1960s and 1970s arose despite the fact that all its services were subject to common-carrier regulation.

A second concern is raised by the fact that telephone companies are regulated common carriers, whereas cable systems operate as largely unregulated, non-common carriers. As such, the cable system has greater freedom to choose the voice and data markets in which it competes and the prices it establishes. It need not participate in costly and time-consuming regulatory proceedings to justify whatever services and prices it proposes. Instead, these matters are settled through individual negotiations. This process is described by one cable operator as follows:

> Commline does not deal with the general public. It either selects its customers or responds to individualized requests for proposals which are based on individual customer needs that are then matched with the capacity and characteristics of the institutional cable system. Once a customer is identified or has requested Commline service proposals, negotiations are undertaken.[23]

With this freedom, the cable operator may be able to establish prices below those of the telephone company, even if its costs are higher. Thus, the cost savings that some users enjoy by bypassing the local telephone network may reflect not underlying cost savings but rather the regulated telephone company's inability to meet competition in particular markets. While telephone companies could be given greater flexibility in their pricing and service offerings, to do so would trigger concerns that telephone companies will compete by pricing competitive services below cost and compensate by increasing prices to their monopoly rate payers.

This disparate treatment presumably would disappear as competition increases between the two companies. As the cable system offers progressively more "telephone-like" services, pressure would mount for requiring them to be offered on a common-carrier basis—all the more so if the survival of the telephone company were threatened. The importance of the lack of regulatory parity today lies in giving cable companies an initial advantage in offering a limited range of competitive services—an advantage offset to some degree by the possibility that telephone companies will engage in cross-subsidization of these services.

The most serious drawback to lifting the cross-ownership ban is that mergers between telephone and cable companies would retard the competition now growing between the two industries. It is likely, therefore, that even if the Commission were to eliminate the ban, such combinations would be examined closely by the Department of Justice.

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[23]Cox Cable Communications, Inc., et. al. *Petition for Declaratory Ruling* (before the FCC), April 22, 1983, at 23.

At the same time, one might argue that retention of the ban would reduce research and development activities that would lead to the integrated facilities that, by the assumptions of Case 3, would be more efficient than separate facilities. However, telephone companies are free today to offer television and other broadband services, so long as they do not involve the retransmission of broadcast signals.[24] Such offerings could become economically attractive in areas with good over-the-air service and, hence, where the prohibition against retransmission would not be a serious handicap. The cross-ownership ban would, therefore, not necessarily foreclose the research and development needed to provide integrated services. If, at some later time, it becomes clearer that a single firm offering integrated services would be the most economically efficient solution, the ban could be lifted.

Case 4: Strong Economies of Scope; Weak Economies of Scale. Suppose that fiber optic transmission systems (or other transmission systems) become so inexpensive that two or more systems can operate economically side by side. Although each system may have a good deal of excess capacity, the cost of the excess capacity may be so small that it is outweighed by the benefits of competition. Sustained competition could exist without a single integrated firm emerging as a natural monopoly.

In this situation, the ban should be abolished. Weak economies of scale would help to ensure that other firms would enter the market if combinations of telephone and cable systems threaten to exercise market power, while firms would have full freedom to exploit economies of scope. The danger of predatory pricing would be lessened because of the ease of market entry. As in previous cases, the lack of regulatory parity would pose a problem, with competitors to telephone companies still free to pick and choose their customers at negotiated prices.

Summary. To recapitulate, in Case 1, whether or not the ban on telephone-cable cross ownership is retained would make little difference, since competition is not possible in any event and problems of cost shifting can be contained. In Case 2, the ban promotes competition without offsetting efficiency losses. In Case 3, lifting the ban would permit cost savings through integrating facilities. However, at least initially, the ground rules for competition would differ between telephone and cable companies. Moreover, the assumptions underlying this case may not be realistic in the foreseeable future. In Case 4, a

[24]The divested Bell operating companies would, however, continue to be subject to the terms of the Modified Final Judgment.

stronger basis exists for lifting the ban, because market entry would constrain attempts to exercise market power, whereas firms would be able to fully exploit the economies of integrated operations.

BASING DECISIONS ON LOCAL MARKET CONDITIONS

Using the preceding analytic framework, we examine here the possibilities of continuing or abolishing the ban in light of circumstances found in particular local markets. These include abolition of the ban in markets where cable is well established, and use of a case-by-case approach with a variety of criteria for decisionmaking.

The Well-Established Carrier Approach

Noam proposes that telephone companies be permitted to provide, on a regulated common carrier basis, television services to the public on integrated facilities, "*provided* that a well-established cable company is already operating in that area."[25] This approach is intended to discourage the telephone company from subsidizing or otherwise favoring its television services as a tactic to stifle the development and growth of a competing system.

In assessing Noam's approach, there are two situations to consider: In the first, one or more cable systems are already well established (however the term is defined) so that a telephone company would be permitted immediately to compete; in the second, this condition is not met.

Competition Permitted Immediately. The results of Noam's approach would be the same as those described above, except that here the cable system would be in a stronger position by virtue of already being well established. In Case 1, his approach would have no effect on society, since competition would not develop in any event. In Case 2, the danger arises that telephone and cable companies would merge if permitted to do so by the antitrust authorities. In Case 3, we would expect one firm to survive, but again with no assurance that it would be the least-cost provider of integrated services. Noam's approach would discourage a predatory strategy, since the prospects of driving out the cable system, already "well established," would be reduced. But his approach does not address the lack of regulatory parity. As before, cable systems may profitably be able to offer competitive services even

[25]Eli Noam, "Towards an Integrated Communications Market: Overcoming the Local Monopoly of Cable Television," 34 *Federal Communications Law Journal* 209, at 241 (emphasis in the original).

if their costs are higher than those incurred by telephone companies. In Case 4, his approach would not apply because whether or not a cable system is yet well established, the lack of barriers to entry would make predation by telephone companies unattractive.

Competition Not Permitted Immediately. In markets where cable is not yet well established, the telephone company would not be permitted to offer television services involving retransmission of broadcast station signals. But these markets are likely to be those where there is good over-the-air reception from a number of broadcasting stations. In such situations, the ban would not prevent telephone companies from offering a variety of television services, as noted earlier. The principal constraint would lie not with the ban but with technology not yet well enough developed to offer economically attractive possibilities of combining television and telephone services to residential subscribers. If technological advances continue, making such combinations attractive, telephone companies presumably will take advantage of them. By offering television service in a market already well covered by over-the-air broadcast stations, the telephone company could preclude cable companies from *ever* becoming fully established in that market, if strong scope and scale economies exist, as in Case 3. If so, the public would be denied the opportunity of receiving retransmitted over-the-air signals unless the ban were abolished.

A Broader Case-by-Case Approach

Noam recommends a single criterion—the existence of a well-established cable system—to decide whether the cross-ownership ban should be relaxed. However, other criteria could be used, similar to those we have discussed in previous sections, with perhaps superior outcomes to an approach that focuses on only one. This broader approach is consistent with the present provisions that the cross-ownership ban may be waived "upon showing of good cause."[26] For example, a telephone company could be granted a waiver of the ban if it could show that the local telephone market is becoming increasingly competitive from sources other than cable television,[27] or if it demonstrates that strong economies of scope exist.

[26]47 C.F.R. sec. 63.56(a).

[27]For example, AT&T, op. cit., at 18–19, cites developments in addition to cable television that are increasing competitive pressures. It notes that private microwave is widely used to bypass local telephone networks. Of the 107 million private circuit miles that existed at the beginning of 1983, 20 percent were in the hands of state and local governments that provide services to themselves as substitutes for telephone service. One commercial application of microwave, digital termination service, is being used in New York City to connect subscribers for data and other services. On the basis of appli-

This approach is usefully illustrated by the leaseback of a portion of a 112-channel system proposed by Pacific Telephone for Palo Alto and adjacent communities in California.[28] Pacific's proposal involves leasing to the local participating governments an interactive 80-channel coaxial cable system that would serve more than 50,000 homes. A fiber optic supertrunk from a headend on the Stanford University campus to two hubs (located at Pacific's central telephone offices) would be used to distribute signals to the subscriber network. The local governments, operating under a joint powers agreement, would seek competitive bids for an organization to manage the system. That organization, in turn, "can seek public input for the mix of programs and services the communities want, then sublease the channels to competing service providers."[29]

In addition, the proposal includes an institutional network, "wholly owned, operated, and maintained by Pacific, which will consist of a separate all fiber optic digital network capable of providing a full range of computer, high speed data, and full motion video services to concentrated business areas, government offices, and educational institutions in the mid-peninsula area."[30] Both the television and institutional networks would be connected to Pacific's telephone system covering the Bay area.

This proposal differs from a standard leaseback in that the subscriber network would not be fully separated (except for shared poles and conduits) from the telephone company's other facilities. Pacific would retain control of the remaining 32 channels of the subscriber network beyond the 80 channels leased to city governments and it would have full control of the institutional network to be interconnected with the subscriber network.

Construction of Pacific's subscriber network would probably foreclose the emergence in the franchise area of independent cable systems that might offer services competitive with Pacific's offerings. Thus, the proposal raises questions about (a) the degree to which competition is likely to be reduced by Pacific's ownership and partial leaseback of the system, (b) the extent to which Pacific's market power will likely be limited by competition from other sources, such as from DTS and private networks, (c) the extent of economies of scope, given that some facilities will be shared (Pacific's central offices), while residential

cations that have been filed, AT&T estimates that DTS will be offered within the 200 largest standard metropolitan statistical areas during 1984.

[28]Pacific Telephone and Telegraph Co., *Pacific Telephone's Wideband Telecommunications Proposal*, San Francisco, California, October 1983.

[29]Id., at 3.

[30]Id., at 1.

subscribers would continue to have separate facilities—conventional telephone wires for voice and data, and coaxial cable for television, and (d) the problems likely to arise in allocating common costs to ensure against cross-subsidization.

Responding to such concerns, the Palo Alto City Council rejected the Pacific Telephone proposal in June 1984. However, Pacific Telephone has not withdrawn its construction application previously filed with the FCC, and that application is being contested by the California Cable Television Association.[31]

A contrasting case involves the C&P Telephone Company. In mid-1984, the City Council of the District of Columbia designated District Cablevision, Inc. (DCI) to negotiate a cable television franchise with the district. In its franchise application DCI proposed to lease facilities from C&P. Unlike the Pacific's Palo Alto proposal, however, C&P does not plan to reserve for its own use a portion of the residential cable system. Moreover, DCI would be free to offer competitive services. As C&P states in its application before the FCC:

> C&P's role as the provider of the broadband transport facilities will not preclude the Customer [DCI or its successor] from using the facilities to provide any telecommunications service in competition with C&P. C&P reserves the right to oppose its Customer's provision of any service which, in C&P's view, may not lawfully be provided by the Customer. However, C&P shall not discontinue provision of facilities and service to the Customer by reason of such opposition, except pursuant to an order of an appropriate governmental authority.[32]

Issues similar to those above will arise as other telephone companies propose leasing arrangements that reflect new technological opportunities. A flexible case-by-case approach may usefully accommodate these situations, albeit with greater administrative burdens on the FCC.

CONCLUSIONS

No compelling basis exists for lifting the telephone-cable crossownership ban, in light of today's technological and marketing environment. Of key importance is that, under the ban, telephone companies are free to develop and use integrated communications systems as long

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[31]*Petition to Deny or Dismiss of the California Cable Television Association*, W-P-C-5384, July 2, 1984.

[32]The Chesapeake and Potomac Telephone Co., *Application* before the Federal Communications Commission, September 10, 1984.

as they do not retransmit broadcast station signals. Such systems may eventually become attractive in geographical areas where over-the-air reception is good, similar to the competition emerging between MDS systems (which also are not now used to retransmit broadcast station signals) and cable.[33] At the same time, elimination of the ban could trigger mergers and acquisitions between telephone and cable systems, with an undesirable increase in market power.

Evidence of developments that would trigger reconsideration of the ban include proposals by telephone companies for integrated telephone and television facilities for residential subscribers in geographical areas with good over-the-air service, accompanied by strong telephone company interest in moving into other areas where the present ban would pose a serious handicap.

Today, a better approach would be to grant waivers of the ban selectively. Evidence of strong economies of scope or the lack of anticompetitive effects would be among the criteria for judgment. Initially, this approach may prove useful in judging the wisdom of leaseback arrangements, under which a portion of the capacity of the system is retained for use by the telephone company.

Perhaps of greater policy importance than the ban in the near term are the problems associated with the lack of regulatory parity between telephone and cable service—a problem that will persist regardless of whether the cross-ownership ban is lifted.

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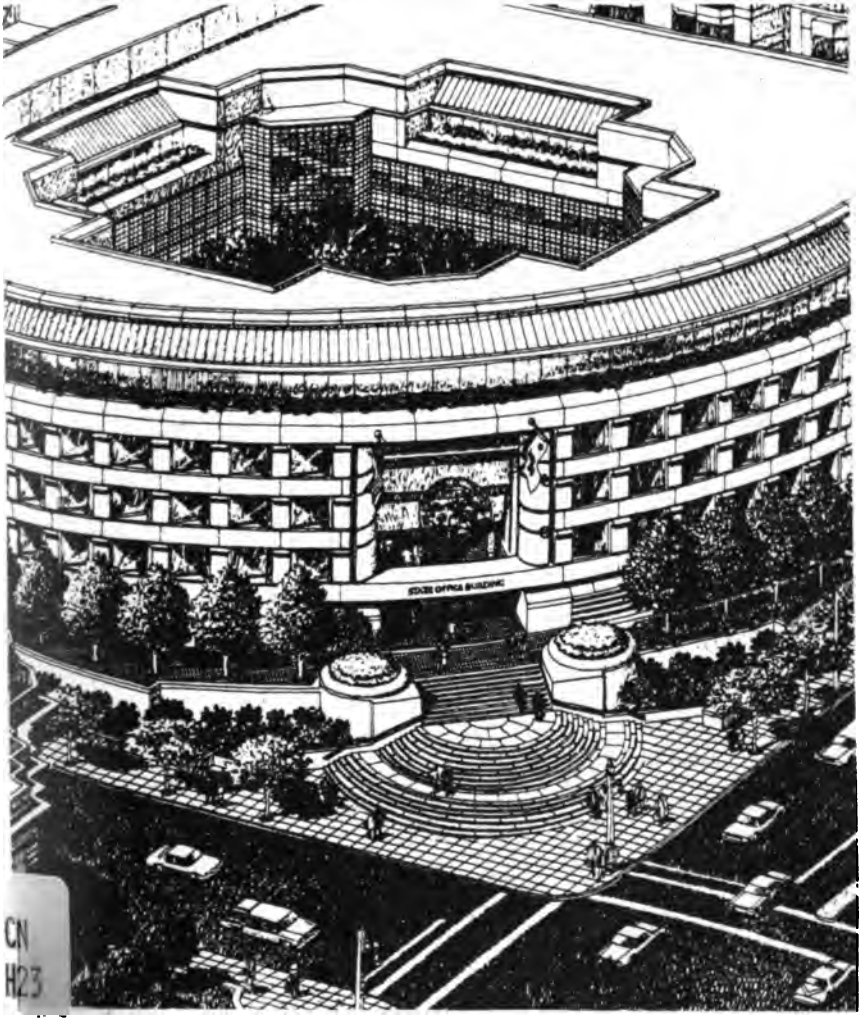
[33]Although telephone companies are not prohibited under the ban from offering broadband services to residential subscribers, any attempt to do so would surely be opposed by the cable industry. As an outcome of litigation, telephone companies might be unable to proceed despite the freedom they have under the ban.

[redacted]

HOW THE CALIFORNIA PUBLIC UTILITIES COMMISSION REGULATES PUBLIC UTILITIES AND TRANSPORTATION COMPANIES



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A HANDBOOK

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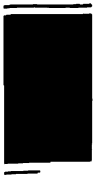

TABLE OF CONTENTS

	Page
INTRODUCTION	1
BACKGROUND	3
HOW THE COMMISSION IS ORGANIZED	5
WHAT THE COMMISSION DOES	6
HOW THE COMMISSION SETS RATES	8
General Rate Cases	8
Energy Cost Offset Proceedings	10
Advice Letters	10
HOW THE COMMISSION GRANTS AUTHORITY	11
Certificates of Public Convenience and Necessity	11
Security Issues	11
Expedited Application Docket	12
Other Tariff Changes	12
HOW THE COMMISSION HANDLES COMPLAINTS	12
Informal Complaints	13
Formal Complaints	14
HOW THE COMMISSION INITIATES FORMAL ACTION ON ITS OWN	15
Order Instituting Investigation (OII)	15
Order Instituting Rulemaking (OIR)	15
HOW THE DECISION-MAKING PROCESS WORKS	16
Public Participation Encouraged	16
Intervenor Funding	17
Public Hearings	18
The Decision	20
Rehearing and Review	21
GLOSSARY	25

INTRODUCTION

This handbook gives a brief description of what the California Public Utilities Commission (PUC) is and does.

The public utilities and transportation companies regulated by this Commission are private, investor-owned companies. The State of California does not own or manage them, nor does any city or governmental district.

These companies are owned by investors who expect a return on their investments. A small company can be owned by a single family or individual. In the larger companies, the investors are shareholders who own stock in the company. Either way, it is the owners who decide who will manage their utility and—as in any private company—the managers are responsible to the owners for the way the company operates.

How then, does the PUC fit into this picture? Basically it comes down to three things: Rates, Service and Safety. The PUC sets the rates, regulates the service and monitors the utilities' operations for safety.

In carrying out its mission the PUC solicits comments and other input from all parties affected by its actions, particularly from the customers of the regulated utilities.

In regulation, terminology is used that may be unfamiliar like "rate base", "normalization" and "minimum rate tariff." In this handbook, we italicize each of these terms when it is first used and then explain it in the text or in the glossary at the end. The glossary also defines many regulatory terms that do not appear in the text.

BACKGROUND

California has a long tradition of regulation to protect its citizens. In 1853, before there was a mile of railroad track in the state, a law was passed making it illegal to charge more than 20 cents a mile for hauling passengers. In 1873, the Legislature created the State Board of Transportation Commissioners, giving it limited jurisdiction over railroads. In 1911, the voters established the present Commission by constitutional amendment. Thus, California has one of the few utility commissions firmly based in the State Constitution rather than legislative enactment. At first it was called the Railroad Commission and had broad powers to regulate railroads and private utilities. In 1946, its name was changed to the Public Utilities Commission. The Commission's present duties and powers have been put into effect by the Legislature, starting with the 1912 passage of the Public Utilities Act.

The basic philosophy of utility regulation was well-expressed by Franklin D. Roosevelt when, as Governor of New York, he said:

> "The Public Service Commission is not a mere judicial body to act solely as umpire between complaining consumer or complaining investor on the one hand, and the great public utility system on the other hand. . . . The Public Service Commission has a definitely delegated authority and duty to act as the agent of the public themselves; it is not a mere arbitrator as between the people and the public utilities, but was created for the purpose of seeing that the public utilities do two things: first, give adequate service; second, charge reasonable rates. In performing this function, it must act as agent of the public, upon its own initiative as well as upon petition, to investigate the acts of public utilities relative to service and rates, and to enforce adequate service and reasonable rates.
>
> "The regulating commission, my friends, must be a Tribune of the people putting its engineering, its accounting and its legal resources into the breach for the purpose of getting the facts and doing justice to both the consumers and investors in public utilities."

(Public Papers and Addresses of Franklin D. Roosevelt, Volume 1, page 731.)

HOW THE COMMISSION IS ORGANIZED

The Commission consists of five commissioners appointed by the Governor, and approved by the State Senate, for terms of six years. Their terms are staggered to assure that experienced commissioners are always on the panel.

One of the five is elected annually by the other commissioners to serve as president of the Commission. The president acts as the chairman at the decision-making *meetings* and other formal sessions. He or she assigns Commission cases to the commissioners.

The Commission appoints an executive director who is responsible for the day-to-day operations of the Commission, directs the staff, and ensures that matters before the Commission are processed efficiently and expeditiously. However, the five commissioners make all final decisions.

The staff is composed of an executive office and seven operating divisions, each headed by a director. Just over a thousand people make up the staff, including attorneys, accountants, computer experts, engineers, transportation experts, economists, rate and safety experts, researchers, other professionals and support personnel.

By law, the PUC headquarters is in San Francisco. The Commission also has an office in Los Angeles and an Office of Governmental Affairs in Sacramento. Field offices for trucking regulation are located in Bakersfield, Downey, El Centro, El Monte, Eureka, Fresno, Oakland, Redding, Sacramento, San Bernardino, San Diego, San Jose, Santa Ana, Santa Barbara, Santa Rosa, Stockton and Van Nuys. Documents can be received at San Francisco, Los Angeles or San Diego.

WHAT THE COMMISSION DOES

The Commission has essentially three types of formal proceedings:

APPLICATIONS—for rate increases, Certificates of Public Convenience and Necessity or other operating authority, Security Issues (stocks, bonds, etc.), certain Tariff changes, and Deviations from any of the Commission's rules or regulations.

COMPLAINTS—by individuals or groups against a regulated utility or transportation company.

ORDERS INSTITUTING INVESTIGATION (OIIs)—investigations initiated by the Commission to examine specific issues that may lead to legislation, rate revisions, enforcement of lawful rates, changes in rules or policies, adoption of new programs or enforcement action against a transportation company. A variation of OII is "OII—Rulemaking", a proceeding that establishes general rules for public utilities. Another variation, a Suspension and Investigation Order, suspends a utility's tariffs pending an investigation, either on the Commission's own motion, or if a utility's tariff proposal is protested.

The PUC regulates more than 22,000 transportation companies and 500 privately-owned utilities. Transportation utilities regulated by the Commission include railroads, bus companies, trucking companies and marine vessels transporting passengers or freight in intrastate commerce. The Commission requires regulated truck and bus companies to maintain a minimum amount of public liability and property damage (PL&PD) insurance to protect the public. It also has some safety jurisdiction over designated rapid transit systems, such as the BAY AREA RAPID TRANSIT District (BART).

Other utilities regulated by the Commission include gas, electric, water, steam, sewer, pipeline, telephone and telegraph, cellular and radio-telephone companies, with some safety jurisdiction over cable television facilities.

Safety for the public and for utility employees is a major responsibility of the Commission. Included are a variety of operations from overhead power and communication lines to gas facilities. Also of concern are the environmental impacts of utility construction and operations.

A regulated utility may not increase any rate or charge without PUC authority. The PUC sets rates by estimating a utility's reasonable expenses and revenues, then adding a "fair and reasonable" *rate of return* on its investment. No utility, however, is guaranteed a profit, merely a reasonable opportunity to earn one.

To assure that the utility's management decisions take the public interest into account, the utility must have authorization from the Commission to transfer utility property, issue stocks and bonds and, in some cases, construct or extend plant or other facilities. The Commission requires utilities to use uniform accounting systems and file annual reports. These annual reports and some other documents are available for public inspection. If you need help contact the Public Advisor's Office.

The PUC acts in both a judicial and legislative capacity. Like a court, it may take testimony, issue decisions and orders, cite for contempt, and subpoena witnesses or records. Its major legal duty, however, is to regulate privately-owned utilities and to secure adequate services, at reasonable rates, for both utility customers and shareholders. Any unauthorized deviation from the Commission's established rates is prohibited by law.

HOW THE COMMISSION SETS RATES

The Commission sets rates in three primary ways: through *general rate cases,* through offset *proceedings*—both of which result from *applications* filed by the utilities—and through *Advice Letter* filings.

General Rate Cases

When a utility files an application for a general rate increase, it selects a *test year* in the future on which to base its financial projections to determine what its *revenue requirement* will be in that year.

When a major utility seeks a general rate increase, it files a *Notice of Intent (NOI)* with the PUC. This contains working data in support of its eventual application. When the Commission staff accepts these documents as complete, the NOI filing is then formally accepted by letter from the PUC executive director. An application is filed 30 days later.

Traditionally, general rate cases have been the major regulatory proceeding, because in these cases the Commission takes a thorough look at the utility's financial picture. The Commission's Public Staff Division (PSD) examines quality of service, prudence of management decisions, effectiveness of conservation programs and many other factors. The PSD then makes its recommendations to the Commission which considers them along with recommendations from other parties in the proceeding. The PSD's recommendations are based on its responsibility to look after the long-term interests of all ratepayers.

General rate applications for major utilities may be filed every three years and take about a year to complete. In the process, the Commission must set rates that are fair both to consumers and to utility stockholders (which means thousands of individuals, and indeed most of us, since utility stocks are purchased by pension funds, universities, insurance companies and other large institutional investors).

To do this, the Commission first establishes the utility' s *rate base;* that is, the value of the utility's plant and equipment devoted to public use. Generally, the rate base is calculated by adding up the original cost of all the power plants, telephone exchanges, gas pipelines, etc., and then subtracting the accumulated *depreciation* and accumulated *deferred* income tax. Depreciation is the amount a utility can deduct each year from the value of its plant and equipment, recog-

nizing that the value declines with each year of its use, just as a new car depreciates in value each year. The equipment included in a company's rate base is financed through private means—by shareholders and lending institutions. It is on that rate base that the utility has an opportunity to earn a rate of return. It recovers the depreciation through an allowance for depreciation expense.

The rate of return is expressed as a percentage of the rate base. It includes interest on borrowed funds, plus dividends on preferred stock and a reasonable allowance for a *return on equity* (common stock). At present the Commission is allowing utilities rates of return on rate base that range between 11.0% and 13.0%.

Next, the Commission determines the estimated operating expenses it will approve for the utility. These include wages, taxes, supplies, depreciation and other expenses. The company may not include certain items in operating expenses, however. Among these are the cost of informative newsletters sent with utility bills, lobbying activities, institutional advertising, dues in civic organizations and charitable contributions. These costs must be paid by the shareholders and cannot be charged to ratepayers.

At this point the Commission has arrived at the utility's annual gross revenue requirement expressed in dollars. The gross revenue requirement is the amount the company is entitled to receive—the total of its rate of return on rate base, plus its allowed operating expenses, including taxes.

Does this mean the utility is guaranteed a profit? No, it only means that the company is entitled, through prudent management and efficiency, to recover the approved revenues and to try to earn the authorized rate of return.

The final step is deciding how the rate increase should be applied to the utility's various classes of customers—residential, agricultural, commercial, industrial, wholesale, and sub-classes within each. This *rate spread* may be applied equally, for instance, for energy utilities by a 10% increase for each category, or by a uniform cents per unit—per *therm, kilowatt-hour (kWh),* or cubic foot. In a general rate case, the PUC weighs many factors in arriving at a rate spread, such as what it costs to serve each class, the value of the service to the customer, threats of bypass, the ability to switch to an alternate service (as from natural gas to fuel oil), the ability to pay, and conservation incentives. For telephone

rate cases, the rate design spreads increases to basic monthly rates, rates per message, long distance rates, connection charges, and rates for specialized services.

Energy Cost Offset Proceedings

While most elements of ratemaking can be predicted in a general rate case, a few can change substantially between general rate cases. This is particularly true today in the energy field where the cost of oil and natural gas has been changing sharply at rates difficult to predict. Offset procedures have been designed to enable utilities to keep pace with changing costs, in the intervals between general rate cases, through rate adjustments to offset changes in those costs.

The Public Utilities Code requires the use of *balancing accounts* to make certain that the utility recovers through rates the exact amount of the increase in expenses that it has experienced—no more, no less.

Offset proceedings are used to consider utility applications for rate increases associated with major plant additions, such as new nuclear electric power plants. These proceedings are also used to consider applications to *decrease* rates because of lower inflation, lower fuel costs, or lower financing costs.

Advice Letters

An advice letter is a letter-application in which any utility or district of a utility may request authority for a general rate increase if the estimated annual operating revenues, including the requested increase, are no greater than $750,000 (for certain smaller telephone companies, there is no operating revenue restriction). The utility's filing must include facts justifying the increase because these proceedings do not normally involve public hearings. The advice letter procedure is used extensively by about 300 smaller water utilities.

Under certain circumstances, a utility may make changes in its rates or services by filing those changes in an Advice Letter. Advice Letter filings usually involve changes that do not require public hearings.

HOW THE COMMISSION GRANTS AUTHORITY

Certificates of Public Convenience and Necessity

Before a public utility begins operations or makes significant additions to its plant, it is generally required to apply for and obtain a *Certificate of Public Convenience and Necessity (CPCN).* This is to ensure that no plant facilities are built, or transportation services begun, that the public does not need.

The standard for "Public Convenience and Necessity" is not specifically defined by statute. The Commission has broad discretion to grant or deny these applications.

An application for a certificate must be filed with the Commission in accordance with its Rules of Practice and Procedure. The applicant must provide the Commission with certain information. It should demonstrate: (1) that the public welfare would be served; (2) that the operation is financially sound and able to provide the proposed service; and (3) that the project, with the exception of highway transportation service, would not unreasonably interfere with the operation of a nearby or competing public utility. Since applicants are also subject to the California Environmental Quality Act (CEQA), an environmental impact statement may be required.

Security Issues

A public utility must receive PUC authorization before it may issue stocks, bonds, or other securities; sell, transfer, lease, or encumber utility property; or assume a liability when acquiring control of a public utility. Commission authorization must be obtained by any party seeking to acquire control of a public utility through acquisition of its securities.

Financial experts on the Commission staff review each application for such authorization and prepare a study of the effect of the proposal on the utility's financial situation. This is considered by the Commission in its decision-making process, which may include a public hearing where utility and staff witnesses testify and may be cross-examined. Such a hearing may be held when a utility is asking for an exemption from the *competitive bidding rule.*

Expedited Application Docket

The Commission recently adopted an alternate procedure for handling requests for approval of special service contracts between public utilities and their gas or electric customers. The new procedure allows for a workshop to be held 20 days after the application is filed, during which protests can be made and questions asked of utility representatives. A decision will be issued at the first meeting after the workshop, where appropriate. The new procedure is experimental and is planned to last one year.

Other Tariff Changes

In addition to the formal proceedings discussed above, much of the Commission's work is related to tariff filings submitted by the utilities. These filings are generally made to do one of the following:

1. To initiate a new service.
2. To change rates to reflect cost changes.
3. To modify rules governing the provision of service, rendering of bills or similar items.
4. To withdraw a service.

Such tariffs usually require specific Commission authorization based on a showing by the utility. In most instances, if there are no protests and the Commission determines that the changes are reasonable, such authorization is granted without a hearing.

HOW THE COMMISSION HANDLES COMPLAINTS

Regulated utilities are required by law to provide reasonably adequate utility service at rates authorized by the Commission. When such service is not provided or there is a dispute over charges for the service, a complaint may be filed by an individual or group.

Procedures for filing complaints against utilities under Commission jurisdiction are: first, for the customer to try to resolve the matter with the utility; second, to bring the matter to the Commission staff for an informal resolution; and third, if the first two fail, to file a formal complaint before the Commission.

Informal Complaints

The informal complaint process is used to arrive at a settlement without resorting to the more costly and time-consuming formal complaint procedure. Consumers may bring their questions or complaints to the Consumer Affairs Branch (CAB) or, for transportation matters, to the Transportation Division. Addresses and telephone numbers of each are:

In Northern California:
(Consumer Affairs Branch or Transportation Division)
California Public Utilities Commission
Edmund G. Brown State Building
505 Van Ness Avenue
San Francisco, CA 94102
(415) 557-0350—Utility Complaints
(415) 557-2298—Transportation Complaints

800-548-9919

In Southern California:
(Consumer Affairs Branch or Transportation Division)
California Public Utilities Commission
New State Office Building
107 South Broadway
Los Angeles, CA 90012
(213) 620-2570—Utility Complaints
(213) 620-2432—Transportation Complaints

1-800-648-6967

Although informal complaints may be submitted by telephone it is better to put them in writing. No special form is required, but it is important that statements are complete and clear so the staff is thoroughly informed of all the facts. Copies of bills or letters relating to the dispute should be included.

If the amount of a bill is questioned, a customer may deposit the amount in dispute with the Commission to prevent discontinuance of service. The Commission will not impound money for matters such as a rate protest, rules or service complaints, or objections to the sources of energy. In such instances, funds sent to the Commission are simply returned to the sender.

After reviewing the customer's complaint, the utility's position, the utility's rates and rules compliance, and analyzing data such as meter tests, meter reading logs, bills, voltage charts, statements of account, etc., the staff issues its conclusions. The staff will notify each party of its findings and send any impounded money to the customer, and/or to the utility.

A customer who is not satisfied with the staff's conclusions may file a formal complaint with the Commission.

Formal Complaints

A formal complaint may be made to the Commission by any individual, corporation, or other organization. *Complainants* must state a cause of action, which can be any action that violates any Commission provision, law, order, or rule.

By law, complaints about the reasonableness of rates can be made only by political subdivisions or by groups of 25 or more customers or potential customers.

A formal complaint has a narrow scope. The customer must complain about matters within the Commission's jurisdiction. For example, the Commission can order a refund if it determines that a utility has overbilled a customer. It can also order reparation for a service that has been paid for but has not been provided. However, the Commission cannot award damages for claims such as personal injury, property damage, emotional distress, or loss of wages or profits. A customer must go to court to recover damages.

Complaints brought before the Commission are processed in much the same manner as a civil action before a trial court. The PUC has a procedure, similar to a small claims court, for cases involving less than $1,500. These cases are handled under the *Expedited Complaint Procedure (ECP).*

The ECP provides that a hearing, without a court reporter or legal counsel, is held within 30 days after the utility's answer to the complaint is filed. There is no pleading, other than the complaint and answer, and the parties represent themselves as in a small claims court. However, either party may petition for reversal of the judgment.

Although a formal complaint is usually heard by an administrative law judge (ALJ), the Commission makes the final decision.

HOW THE COMMISSION INITIATES FORMAL ACTION ON ITS OWN

Order Instituting Investigation (OII)

OIIs are investigations initiated by the Commission to explore broad policy issues, resolve procedural issues, investigate charges of improper or illegal activity by a regulated utility or transportation company, or respond to directives from the Legislature.

OIIs name one or more utilities as respondents and usually require them to take specific action (e.g., file data on a particular subject or respond at hearings to matters specified in the order).

OII—Order Instituting Rulemaking (OIR)

These investigatory proceedings are instituted by the Commission to consider rules or guidelines that affect more than one utility. Comments and proposals are submitted in written form. Oral arguments or presentations are sometimes allowed. The process is similar to the way federal agencies conduct rulemaking.

The PUC's decision is often reflected in a *General Order* which is published and available at the PUC's offices in San Francisco and Los Angeles.

HOW THE DECISION-MAKING PROCESS WORKS

Public Participation Encouraged

The Commission encourages interest groups and individuals to participate in its proceedings. The Commission has taken two major steps to encourage public participation; it established the Public Advisor's office, and adopted Rules that created an intervenor funding program.

The Public Advisor's office was established by the Commission in 1983 in response to legislation passed in 1982. The statutory responsibilities of the Public Advisor's office include:

- providing procedural information and advice to people who want to participate in formal PUC proceedings;
- advising the Commission on barriers to effective public participation.

The Public Advisor's office also serves as a contact to locate resource people at the PUC who can respond to specific questions or provide needed information. The Public Advisor's office does not speak *for* any group or individual in formal proceedings. Neither does the office handle the *initial* investigation of a consumer's service or billing problems with the utilities. These are initially handled by the Commission's Consumer Affairs' staff. If, after working with Consumer Affairs, a person wants to file a *formal* complaint, then the Public Advisor's office can help.

The Public Advisor has an office in San Francisco and in Los Angeles. The addresses and telephone numbers are:

Public Advisor's Office
Room 5303
505 Van Ness Avenue
San Francisco, CA 94102
(415) 557-0890, or TDD # (415) 557-0798

Public Advisor's Office
Room 5109
107 So. Broadway
Los Angeles, CA 90012
(213) 620-3454, or TDD # (213) 620-0709

Intervenor Funding

The Commission established the intervenor funding program in 1983 to encourage and reward public contributions to our decisions. (Intervenor is the term used for any participant in a PUC proceeding other than the Commission staff and utility representatives). In 1984, the Legislature codified a modified version of the intervenor funding program which governs all proceedings started after January 1, 1985.

Individuals or groups who intervene in PUC proceedings may be eligible for compensation if they can show:

- that their participation in PUC proceedings creates a financial hardship, and
- that they have made a substantial contribution to a PUC decision.

The specific rules governing the program are contained in the PUC Rules (under Article 18.7). Any individual or group seeking compensation should contact the Public Advisor's office, in advance, for assistance in filing for eligibility or compensation.

The program provides after-the-fact reimbursement of those expenses of time and money found to directly relate to the intervenor's contribution.

The Commission has provided nearly $1,000,000 to a wide variety of intervenors (groups and individuals) since the program began.

Public Hearings

The three types of proceedings previously described—applications, complaints and investigations—may all involve public hearings.

In all formal proceedings, one of the PUC's five commissioners is assigned ultimate responsibility for steering the case through its processing. An ALJ is named to conduct public hearings, advise the assigned commissioner of major developments and issues, and prepare a recommended decision for Commission consideration. Other participants from the PUC staff generally include an attorney, a project manager, and witnesses who are experts in various fields.

At the outset, the Commission may schedule a *prehearing conference,* to which all known interested parties are invited. These may include consumer groups, farm associations, business, commercial and industrial groups, local, state and federal agencies, and other utilities. Each may make an *"appearance"* as a *protestant* or an *interested party,* depending on the interests of the group he or she is representing.

At the prehearing conference, each party announces the extent to which it will participate in the hearings. The party must identify the issues it will raise and may be required to announce whether it plans to present evidence, cross-examine witnesses, and submit *briefs.* When the ALJ has an estimate of how much time each of the parties and the PUC staff will need, hearing dates and places are scheduled along with deadlines for the parties to submit and exchange their prepared testimony and exhibits.

In general rate increase applications and, in other cases of wide public interest, hearings designed to elicit comment from members of the public are often scheduled in addition to regular evidentiary hearings. They are often scheduled in the evening and within the service territory of the requesting utility to accommodate the interested public. Representatives of the utility and staff attend to explain and comment on the request. Individuals wishing to do so may then testify under oath or make unsworn statements regarding the issues.

When the Commission sets a matter for hearing, the date, time, and location of the hearing appear on the Commission's *Daily Calendar.* Notice is also sent to all parties known to be interested. News releases may be distributed to the media. In applications for general rate increases, the law

requires utilities to send notices of the application to all customers. In other types of rate increase applications, the Commission requires that notice of the application be printed in newspapers of general circulation and posted in the utility's business office.

Hearings are generally held in the Commission hearing rooms in San Francisco and Los Angeles. They are recorded by a court reporter, and transcripts may be purchased from the Commission. File copies of transcripts are available for public inspection in the PUC's San Francisco and Los Angeles offices.

It is not necessary to be an attorney to participate in Commission proceedings. Parties who wish to participate may represent themselves or be represented by another. Parties may cross-examine witnesses, present witnesses, file briefs and apply for rehearing after a decision has been made. Persons wishing only to testify need not file an appearance.

In complaint hearings, applications or petitions, the complainant, applicant, or petitioner has the burden of proof and presents his case first.

Evidence at a hearing can be given through written documents, *exhibits,* or oral testimony by witnesses. In addition, the Commission may take statements from the general public or other persons interested in the proceedings. A *statement* is recorded by the court reporter and appears in the transcript. However, since it is not made under oath or subject to cross-examination, it has less weight than sworn testimony. Oral and written *testimony* is given under oath and is subject to cross-examination.

At the conclusion of testimony, the Commission may hear arguments in support of the various parties' positions. An argument may take the form of a closing statement made before the ALJ or commissioner on the last day of hearing; or the Commission may have oral argument *en banc,* which means that several commissioners hear the argument. A third form of argument, and the most common, is through briefs. These are written documents summarizing the positions of the parties based on the factual evidence presented.

The Decision

Formal proceedings may generally be divided into two types: *Ex parte* matters and proceedings involving public hearings. The decision making process differs between these two categories.

Ex parte proceedings generally involve applications seeking operating authority or other kinds of permission where no protests are filed. Since these proceedings are not controversial, they are decided on the pleadings and no public hearings are held. After the 30-day protest period expires, the ALJ prepares a draft decision and submits it to the assigned Commissioner. If the assigned commissioner approves it, the draft decision is placed on the agenda for the Commission's next meeting. In ex parte proceedings and complaint cases, the ALJ's draft decision is not available to the public until the Commission signs it.

In proceedings where public hearings are held (except for complaint cases), the ALJ must prepare and file his *proposed decision* within 90 days after submission. The proposed decision is then served by mail on all parties. Parties may file comments on the proposed decision within 20 days after it is mailed and may file replies to comments within 5 days after comments are filed. The ALJ then considers the comments and the replies to comments and revises his proposed decision, if appropriate. He then submits his proposed decision to the assigned Commissioner for his approval and placement on the Commission's agenda. If the assigned Commissioner and the ALJ differ on the resolution of the proceeding, alternate proposed decisions will be placed on the agenda, making changes in the draft if the assigned Commissioner wants them.

Decision-making business meetings of the Commission are usually held every two weeks and are open to the public. At the meeting, if three or more commissioners sign the proposed decision, it becomes the *formal decision* of the Commission. It is given a decision number, and a copy is sent to all parties to the proceeding. The dates and location of the next three meetings are shown on the PUC Daily Calendar.

Rehearing and Review

Any decision or order of the Commission is subject to both administrative and judicial review upon written request of a party. If the Commission denies review (rehearing), the requesting party may ask the California Supreme Court to review the decision. That court is the only state court with power to review the Commission's actions.

RAND/P-3204-MF

GLOSSARY

GLOSSARY

A

ACRS (Accelerated Cost Recovery System)

ADAD (Automatic Dialing Announcing Devices)

AER (Annual Energy Rate)

AFUDC (Allowance for Funds Used During Construction)

ALJ (Administrative Law Judge)

ARA (Attrition Rate Adjustment)

Above the line—A term referring to operating revenues and operating expenses recorded above the net operating income line in a utility's income statement. Above the line operating expenses include operation and maintenance expenses, depreciation expenses, general and administrative expenses, and taxes. Excluded are interest payments, interest income, contributions and other nonutility expenses which are below the line items on an income statement. (See net operating income and below the line).

Accelerated Cost Recovery System (ACRS)—See Accelerated Tax Depreciation

Accelerated Tax Depreciation—A depreciation method which permits a utility to depreciate its property for tax purposes (see CCFT) faster in the early years of its expected life, thereby reducing the company's tax liability in those years.

Access Charges—Charges against telephone toll carrier companies and against individual customers. Access charges for interstate carriers are based on FCC decisions issued in 1983. For intrastate carriers, they are fixed by the California PUC.

Administrative Law Judge (ALJ)—A Commission staff member who serves as a hearing officer at formal PUC proceedings. He or she may conduct public hearings, issue subpoenas, question witnesses, and prepare a draft decision and order for the Commission's consideration.

Advice Letter—A filing by letter made by a utility to change rates or services. An Advice Letter filing usually does not require public hearings. (See page 10)

Agenda—The notice of business the PUC will consider at its formal decision-making meeting.

Allowance for Funds Used During Construction (AFUDC)—A percentage amount added to Construction Work in Progress (CWIP) to compensate the utility for funds used to finance a new plant under construction prior to its inclusion in rate base. The AFUDC rate is based on the net cost of borrowed funds used for construction and a reasonable allowance for equity funds when so used. AFUDC is sometimes known as Interest During Construction (IDC).

Annual Energy Rate (AER)—An electricity rate set once a year in energy offset proceedings which recovers a portion of the utility's fuel and purchased power expenses. This rate is set in advance on a forecast basis and is not subject to adjustment. It provides an incentive to the electric utilities to prudently manage their energy expenses.

Appearance—One who has become a party to a formal proceeding before the Commission by submitting an appearance form to the ALJ at the time of hearing. The appearance may present evidence, cross-examine witnesses, sponsor witnesses, file briefs, and appeal any resulting PUC decision.

Applicant—A person or utility filing a formal application with the PUC, seeking permission to do something.

Applications—One of several types of proceedings through which the Commission develops decisions and policies.

Attrition—The decline in earnings caused by expenses and investment costs increasing faster than revenues.

Attrition Rate Adjustment (ARA)—Raising or lowering the allowance to a utility to compensate for the effects of inflation.

Automatic Dialing Announcing Devices (ADAD)—Computer-generated, these devices automatically dial telephone numbers sequentially. They are usually used as a marketing tool by some businesses and are also known as "junk calls". ADADs are strictly regulated by the PUC.

Average cost pricing—The total cost of producing all the energy sold is divided by the number of units sold so that every customer pays the average cost for the entire system.

Avoided Cost—The incremental cost to an electric utility of electric energy or capacity or both which, but for the purchase from the qualifying facility/facilities, such utility would generate itself or purchase from another source.

B

BOC (Bell Operating Company)

Btu (British thermal unit)

Backhaul—Any paying cargo hauled by a carrier on a return trip after a load of cargo has been delivered.

Balancing Account—An account used to match the collection of actual revenues to actual costs after any Commission-determined adjustments for unreasonable or imprudent costs. Fuel costs or major plant additions are put into balancing accounts until the Commission has determined that they are reasonable. Ongoing costs like fuel costs, which are subject to fluctuation and estimation error, are put into balancing accounts so that utilities do not overcollect or undercollect revenues compared to their out-of-pocket cost.

Barrel of oil—Equivalent to 42 U.S. gallons. The Btu content of a barrel of crude petroleum is about 6,160,000 Btu's.

Baseline—A program providing lower rates for the first units of gas and electricity used. The baseline quantity is to be established at from 50 to 70 percent of average residential consumption. This allowance of gas and electricity is available to all residential customers and is a financial incentive to keep usage at or close to baseline.

Bell Operating Company (BOC)—The local Bell System company after the break-up of AT&T on January 1, 1984. The BOC's regulated franchise is to provide local service and short-haul toll service within calling areas. Pacific Bell is the California BOC.

Bell System—The Bell System was broken up into eight operating companies in early 1984: AT&T (including Western Electric and Bell Laboratories) and seven independent regional holding companies providing local exchange service.

Below The Line—A utility's income statement reflects the total operations of the company, including regulated activities, Commission-disallowed activities, and those beyond the jurisdiction of the Commission. In determining fair and reasonable rates, the Commission "draws a line" between costs used to set rates and costs which are excluded, even though they really occur. Above the Line expenses include operating costs, such as meter readers. Below the Line expenses include unregulated activities or disallowed activities, such as contributions to political action committees.

Bill of lading—A non-negotiable written transportation agreement between shipper and carrier (or their agents).

Brief—A document citing all facts and points of law relied on by a party in a formal proceeding. It is filed at the conclusion of the proceeding.

British thermal unit (Btu)—The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit. A unit frequently used to measure energy.

Bulk freight—Freight not in packages or containers.

C

CAB (Consumer Affairs Branch)

CAM (Consolidated Adjustment Mechanism)

CCCS (Centralized Credit Check System)

CCFT (California Corporate Franchise Tax)

CIAC (Contributions in Aid of Construction)

CLMA (Conservation Load Management Adjustment)

COPTS (Customer-Owned Pay Telephone Service)

CPCN (Certificate of Public Convenience and Necessity)

CPE (Customer Premises Equipment)

CVR (Conservation Voltage Regulation)

CWIP (Construction work in Progress)

Call Bonus—Community and Wide Area Plans—Formerly known as Optional Residence Telephone Service (ORTS). Call Bonus Community is designed for residential customers with one party service who call neighboring communities frequently. This plan is available in major metropolitan areas and provides discounted calling to all parties within 40 miles, or to selected communities within that area. Call Bonus Wide Area is available statewide and provides discounted calling to any destination within the caller's Service Area.

Capital intensive—A condition in which a relatively large dollar investment is required to produce a dollar of revenue. An average electric utility, for example, has an investment of about $4.00 for each dollar of revenue generated annually and is therefore considered highly capital intensive.

Capital structure—The composition of a corporation's invested capital as divided between equity (investors' money) and debt (borrowed money).

Cellular Radio—A high capacity mobile radio system using hundreds of channel assignments and providing service within small areas known as "cells". In the major metropolitan areas of the U.S. there was initially assigned one land line telephone company operator and one non-land line operator providing separate and competing cellular service.

Centralized Credit Check System (CCCS)—California's seven largest telephone companies participate in this program designed to detect and prevent telephone cheating by customers who deliberately fail to pay for telephone services.

Certificate of Public Convenience and Necessity (CPCN)—An authorization granted by the Commission to construct or expand a facility or to begin operations.

Class of Service—A category of customer. Classes of service include residential, industrial, commercial, public authority, street lighting and utility service. For residential service there may be a number of rates, depending on how the gas or electricity is used. The same may be true for other types of service.

Cogeneration—The sequential production of electricity, steam or useful work from the same fuel source, such as the generation of electricity using waste heat from an industrial process.

Common Carrier—Any person or company which unequivocally dedicates to the general public the equipment and property used to perform transportation of property or passengers. Common carriers must accept all business offered to them at posted rates and are regulated as *Public Utilities by the California PUC in Intrastate Commerce,* as well as by the Interstate Commerce Commission for interstate commerce. The term is also used in the communications industry and is defined as "Any person engaged as a carrier for hire in interstate or foreign communication by wire or radio".

Competitive Bidding Rule—A PUC requirement that a utility publicly invite competitive bids from financial institutions wishing to buy (for resale) the utility's security issue.

Complainant—A person or group who files a complaint charging a violation of a law, order, tariff, or rule of the PUC by a utility.

Complaint—A charge by any person that a utility or transportation company under PUC jurisdiction has violated the Public Utilities code or an order or regulation of the Commission.

Conservation Load Management Adjustment (CLMA)—A mechanism established for an electric utility. It tracks the actual expenditures and compares them with the allowance authorized in a general rate case for approved load management programs, CLMA allows for rate adjustments to recover these expenditures.

Conservation Voltage Regulation (CVR)—A two-stage conservation program begun in 1977 in which the Commission ordered electric utilities to reduce maximum service voltage output from 126 to 120 volts.

Consolidated Adjustment Mechanism (CAM)—A term used by Southern California Gas Company to describe a combination of SAM and PGA. (See page 10)

Construction Work In Progress (CWIP)—A plant (e.g., new generating plant, telephone exchange, transmission line, distribution line, central office, etc.) which is under construction by a utility but not yet in service. The PUC historically has not allowed such a plant to be included in a utility's rate base. When construction is completed the balance in the CWIP account is transferred to the appropriate plant accounts and then included in rate base. (Also see AFUDC)

Contract Carrier—A person or company engaging in for-hire transportation of property under individual contract or agreement with one or a limited number of shippers.

Contributions in Aid of Construction—Nonrefundable donations or contributions in cash or properties from individuals, governmental agencies or others for construction or property additions. The utility may not earn a return on contributions.

Cost-based pricing—A method of setting rates based on the cost to the utility to provide that particular service.

Cost of capital—The combined cost of interest on borrowed money, preferred stock dividends and an allowance for common stock earnings needed to provide the facilities used in supplying utility service.

Cost of service—The total cost of providing utility service. The cost components include operating expenses, depreciation, taxes and a rate of return adequate to service investment capital. Cost of service is synonymous with the revenue requirements of the system.

Customer-Owned Pay Telephone Service (COPTS)—Private firms and individuals are able to own the pay telephones in their establishments or on other private premises following authorization by the PUC in November 1985. A monthly rate, rates for local calls (zone 1) in measured exchange areas, and long distance charges in all exchanges are applicable. The owner of the Customer Owned Pay Telephone (COPT) sets the amount charged for calls, with maximum amounts subject to California Public Utilities Commission tariffs. A monthly rate, rates for local calls (zone 1) in measured exchange areas, and long distance charges in all exchanges are applicable.

Customer Premises Equipment (CPE)—Telephone equipment located on customers premises including such items as telephone sets, dialers, key systems, recorders, private branch exchanges, and call-directors. All new CPE purchased since January 1, 1984 has been deregulated.

Cycle billing—The process of reading a segment of a system's meters and billing that portion of its customers each day of a billing period. By the end of the cycle, the complete system is read and billed, and a new cycle begins.

D

DEIR (Draft Environmental Impact Report)

DOE (Department of Energy)

Daily Calendar—A listing of new filings, Commission meetings, Commission decisions, and the date, time and location of all hearings. The public may subscribe to the Daily Calendar on a daily or weekly basis.

Daily Transportation Calendar—A listing of new filings, Commission meetings, informational notices and Commission decisions involving transportation issues.

Declining Block Rate—A rate structure which provides for lower prices per unit of usage as usage increases from block to block. These rate structures are now considered unsatisfactory because they encourage more (rather than less) consumption.

Decommissioning—Used in reference to nuclear power plants and is the process used to dismantle these plants after they have stopped producing power. The dismantlement includes the disposal of radioactive waste materials, the destruction or resale of plant equipment and the return of the power plant site to its original state.

Defendant—The entity, usually a utility, charged in a complaint proceeding with violating the Public Utilities Code or an order or regulation of the Commission.

Deferred Fuel Costs—Those fuel costs incurred in one accounting period which are not reflected in billings to customers until a later billing period (used in energy cost offset balancing accounts).

Deferred income tax—The tax effect of the timing difference between straight-line depreciation used for its financial reporting purposes and accelerated depreciation used for income tax purposes.

Department of Energy (DOE)—The federal agency responsible for energy policy.

Depreciation—A means of accounting for the wearing out or gradual obsolescence of a utility plant or the process through which facilities such as power plants and office buildings decrease in service value over time. As plant is depreciated an allowance for depreciation expense is made. (See Page 8)

Deregulation—A complete elimination or liberalization of controls on pricing, service, entry or safety.

Deviation—Authority formally granted by the Commission to depart from established rates or service requirements.

Digital Switching and Transmission—A system where voice messages are broken into digital pulses, transmitted and switched through the system, then regenerated as voice at the other end of the transmission. This system provides high quality, low noise transmission and lower cost and lower maintenance requirements because it facilitates the use of solid state electronics.

Distance Table--A PUC-published directory of mileages between points in California.

Divestiture—The term applied to the break-up of the Bell System in 1984 as settlement of a Department of Justice anti-trust suit against AT&T.

Draft Environmental Impact Report (DEIR)—Draft version of the report put out by the Environmental Section which evaluates the impact on the environment of a proposed project for which a public utility has applied.

Dray Gas—Gas produced from wells which do not contain liquid hydrocarbons.

E

ECABF (Energy Cost Adjustment Billing Factor)

ECAC (Energy Cost Adjustment Clause)

ECP (Expedited Complaint Procedure)

ERAM (Electric Revenue Adjustment Mechanism)

ERTA (Economic Recovery Tax Act of 1981)

ESLAB (Emergency Spanish Language Assistance Bureau)

Economic Recovery Tax Act of 1981 (ERTA)—ERTA mandates that public utility commissions cannot flow through the tax benefits of ERTA in lower rates. Prior to ERTA, all available tax benefits that a utility could take on its tax return were passed on by the PUC to the ratepayer in the form of lower income tax expense recoverable in rate (flow-through).

ERTA mandates that the tax benefits represented by the difference between book and tax depreciation and most of the investment tax credit (see ITC) are not passed on to the ratepayer through reduced rates. Instead, the tax benefits accrue to the utility through increased cash flow generated by the utility's ability to take the tax benefits as deductions on its tax return producing lower income tax expense. The utility recovers in rates a substantially higher level of income tax expense based upon book depreciation and a very small portion of total ITC available. The difference between ratemaking income tax expense and tax-return tax expense is deferred and deducted from rate base (normalization)

The Commission must normalize the tax benefits of ERTA for ratemaking purposes to preserve the utility's ability to take the tax benefits on its actual tax return.

Electric Revenue Adjustment Mechanism (ERAM)—A balancing account established by an electric utility to record the recovery of base rate revenues against the adopted test year base rate revenues. (On a service rendered basis.) This does not guarantee a return but does assure recovery of test year revenues in order to eliminate estimation errors due, for example, to conservation effects, and allows an opportunity to earn the authorized rate of return. (See page 10)

Emergency Spanish Language Assistance Bureau (ESLAB)—A telephone facility to assist Spanish-speaking telephone subscribers in making emergency calls.

En banc—The commissioners sitting as a group in formal session, usually to listen to oral argument in a proceeding.

Energy Cost Adjustment Billing Factor (ECABF)—The billing surcharge (positive or negative) used to recover energy costs in rates.

Energy Cost Adjustment Clause (ECAC)—A procedure whereby an electric utility periodically adjusts its rates to offset changes in the cost of fuel used to produce electricity. (See page 10)

Evidence—Oral testimony, written documents or physical objects included in the record of a formal proceeding.

Exempt Carrier—A carrier whose rates are not regulated by the Commission. This may be because of legislative action (e.g., emergency vehicles) or Commission decision (e.g., log carriers).

Exhibit—A physical object, usually in writing, offered as evidence at a hearing.

Ex Parte—A Commission order or decision issued without a public hearing. Ex Parte orders are appropriate when it is clear that the application has no serious opposition. The term is also used to describe contacts between a party to a proceeding and the assigned commissioner or ALJ outside of the hearing, in an attempt to influence the outcome of the proceeding. Such contacts are improper.

Expedited Complaint Procedure (ECP)—A procedure for quickly handling formal complaint cases involving less than $1,500. The ECP ensures a hearing, without a court reporter, within 30 days after an answer to the complaint is filed. There is no pleading—other than the complaint and the answer—and the parties represent themselves without counsel. The complaint is heard by an administrative law judge and the final decision is made by the Commission. (See page 14)

Expense Ratio—Operating expenses, interest expense, and taxes divided by operating revenue, interest income and dividend income. (See operating ratio)

F

FEIR (Final Environmental Impact Report)

FERC (Federal Energy Regulatory Commission)

FIT (Federal Income Tax)

Federal Energy Regulatory Commission (FERC)—The branch of the Department of Energy which regulates interstate gas and electric rates and facilities.

Fiber Optics—A technologically advanced communications transmission system using lasers and detectors to transmit and receive information via light waves over very fine glass fibers. This system has a very large capacity and promises provision of lower cost telephone transmission service in the future.

Final Environmental Impact Report (FEIR)—The final version of the Environmental Section report which evaluates the effect of a project for which a utility has applied.

Firm Service—Service such as residential gas or electric service offered to customers under schedules or contracts which anticipate no interruptions.

Flat Telephone Rates—A telephone rate plan allowing the customer to pay a flat monthly rate for unlimited use of local service.

Flow-through of income taxes—An accounting procedure under which income taxes are reported in a company's income statements in the period in which they are incurred. If, as the result of the use of accelerated depreciation in its income tax returns, a utility pays lower income taxes in the earlier years of the life of property, the reduced income tax expense is reported in the utility's income statements in those early years and its revenue needs are likewise reduced. (See normalization of income taxes.)

Formal Complaint—A formal charge that a utility, motor carrier, or person (the defendant) has violated the Public Utilities Code or some order or regulation of the Commission. The complaint must be in writing, and in accordance with the Commission's Rules of Practice and Procedure. The proceeding ordinarily requires public hearing and a Commission decision.

Formal Decision—A Commission decision on a pending application or case signed by a majority of the commissioners.

Freight Forwarder—A firm which combines small shipments into larger truckload or carload lots. A freight forwarder operates on the margin between carload or truckload rates and less-than-carload or less-than-truckload rates.

Fuel Adjustment Clause—A tariff clause which permits a utility to offset changes in fuel costs between general rate cases. No longer used in California. (See pages 8–10 for present procedures)

G

GAC (Gas Adjustment Clause)

GCF (Gross Capacity Factor)

GEDA (Gas Exploration and Development Adjustment)

Gas Adjustment Clause (GAC)—A term used by PG&E to describe a combination of PGA and SAM. Same as Consolidated Adjustment Mechanism (CAM). (See pages 8-10)

Gas Exploration and Development Adjustment (GEDA)—The process by which a utility may apply to the Commission for the right to recover the costs of approved gas exploration and development projects through the utility's rates.

General Order—A Commission order which sets standards, procedures or guidelines applicable to a class of utilities, as distinguished from a decision applicable only to a single utility.

General Plant—A plant where electricity is generated.

General Rate Cases—Cases in which the Commission takes a broad, in-depth look at a utility's revenues, expenses and financial picture and considers quality of service and other factors to arrive at fair rates. These are the major regulatory proceedings before the Commission. (See Pages 8 and 15)

Gross Capacity Factor (GCF)—The Commission adopted a second incentive plan in March 1984 for Edison's San Onofre Nuclear Generating Power Station Unit No. 2. In this plan, a performance standard formula converts recorded annual gross capacity factors (GCF) to dollars of either penalty or reward. When the GCF falls below 0.55, or above 0.80, an amount of penalty/reward is assessed based on the amount and cost of fuel replaced/displaced. Such amounts are equally allocated between ratepayers and shareholders.

I

IAS (Information Access Service)

ICC (Interstate Commerce Commission)

IDC (Interest During Construction)

IEC (Interexchange Carriers)

ITC (Investment Tax Credit)

Informal Complaint—Informal request for assistance made to the Commission with supporting documentation concerning a utility's service, rates or other matters. The staff investigates and tries to arrive at an informal adjustment without public hearing or commission order. Informal complaint files are not available for public inspection.

Information Access Service (IAS)—Usually seen as 976 IAS. IAS is a PUC-authorized telephone utility program which allows customers to receive information from different providers on many different topics. This information is provided for a separate fee and may be about topics such as stock market reports, horoscopes, children's stories, sports scores and adult entertainment. 976 is the intrastate prefix; 900 is the interstate prefix.

Inside Wiring—A Federal Communications Commission ruling that a telephone customer, rather than the local telephone company, must pay for the repairs of telephone wires and jacks inside the customer's premises.

Insurance Requirement—The minimum amount of insurance required by the Commission for a motor carrier or other regulated entity.

Interconnect Company—A nonregulated, nonutility firm providing terminal communications equipment and inside wiring to the public.

Interest During Construction (IDC)—(See AFUDC)

Interested Party—An individual or group appearing in a formal proceeding without declaring in advance a position for or against a proposal in question.

Interexchange Carriers (IEC)—Telephone companies which provide long distance service or sell telephone lines. MCI, Allnet and AT&T-C are examples of these companies. At present, there are 100 of these companies.

Intermodal—The transportation of property by more than one method on one trip (e.g., railroad and truck).

Interruptible Service—Low priority service offered to customers on the condition that there may be interruption on short notice, generally in peak load seasons, in order to serve higher priority users.

Interstate Commerce—Traffic, intercourse, commercial trading, or the transportation of persons or property from any state or territory in the country to another state or territory. (This includes transportation through foreign countries or between two points in one state through another state).

Interstate Commerce Commission (ICC)—The federal body that regulates interstate trucking companies, bus lines, and railroads.

Intrastate Traffic—Traffic whose origin, destination and entire transportation route lie within the same state.

Inverted Rates—A rate structure where the cost for each block of energy increases as usage increases.

Investigation and Suspension—A petition to suspend and investigate tariffs, schedules or contracts which the petitioner claims to be unlawful.

Investment Tax Credit (ITC)—A provision in the federal tax laws that allows a utility credits against income taxes equal to 10% of its new investment in certain types of plant. The Tax Reform Act of 1986 has discontinued the ITC tax benefit.

J

K

Kilowatt-hour (kWh)—One thousand watts of electricity acting for one hour. (e.g., The energy ten 100-watt light bulbs consume in one hour.)

L

LATA (Local Access Transport Area)

LNG (Liquefied Natural Gas)

LPG (Liquefied Petroleum Gas)

LTL (Less-Than-Truckload)

Lawful Rate—A just, reasonable, and nondiscriminatory rate approved by the Commission.

Less-Than-Truckload (LTL)—Shipments in small lots (usually not exceeding 10,000 lbs.) which do not use the full carrying capacity of trucks or trailers. (See truckload)

Lifeline (See Baseline for energy utilities)—Lifeline telephone service provides service at 50% of the regular rate for qualified low income residential customers. Most water companies also offer lifeline rates.

Liquefied Natural Gas (LNG)—Natural gas cooled to -259 F.

Liquefied Petroleum Gas (LPG)—A gas containing certain hydrocarbons which are gaseous under normal atmospheric conditions but can be liquefied under moderate pressure at normal temperatures. Propane and butane are the principal examples of LPG.

Load Factor—The average load of a customer, a group of customers or an entire system, divided by the maximum load. For example, assuming 48 kWh of usage for the day, the average load is 48/24 or 2 kW. If the maximum demand is 4 kW, the load factor is 50%.

Load Management—Techniques or actions which shift electricity demands from peak periods to times (off peak) when existing capacity is not fully used.

Local Access Transport Area (LATA)—This term is applied to the areas designated for the local Bell Operating Companies (BOCs) to provide local service under the Department of Justice—AT&T divestiture plan. California has 10 LATAs served by Pacific Bell. The service between LATAs is provided by competing toll carriers, including AT&T.

Local Telephone Company—A telephone utility that provides exchange telephone service in local areas.

Long Distance Telephone Company—A telephone utility that provides long-distance service, but not local exchange service.

M

MAAC (Major Additions Adjustment Clause)

MTS (Measured Telephone Service)

Major Additions Adjustment Clause (MAAC)—A procedure to enable utilities to recover the cost of owning, operating and maintaining certain designated major plant additions that are placed in service between General Rate Cases (e.g., San Onofre Nuclear Generating Station). A MAAC proceeding is often divided into two phases: the first phase covers ratemaking features for recovery of costs of operating and maintaining the new facility and capital costs; the second phase deals with the reasonableness of the new plant's construction.

Manufactured Gas—Gas obtained by distilling coal, cracking petroleum, or by the reaction of steam passing through a bed of heated coal or coke. Examples are coal gases, coke oven gases, producer gas, blast furnace gas, blue (water) gas and carbureted water gas. Btu content varies widely.

Marginal Cost—The extra cost to produce one additional unit of output in the most economical manner.

Mcf—An abbreviation for 1,000 cubic feet.

Measured Telephone Rates—A telephone rate plan where customers pay for the number of calls and the duration of each call. In California, most business customers are already on Measured Rate Service and in most areas, Measured Rate Service is optionally available to residence customers.

Measured Telephone Service (MTS)—A pricing method that allows customers to pay a low monthly service charge rate also charged for each call made. The total monthly bill depends on how much the telephone is used.

Meetings—Business meetings of the Commission open to the public, where proposed decisions may be discussed and voted upon. (See page 5)

Minimum Rates—Rates established by the Commission as minimum for highway carriers and published in minimum rate tariffs (MRT). When the Commission establishes minimum rates, it is unlawful for a carrier to charge less than the minimum rates unless a deviation has been approved by the Commission.

Motor Transportation Broker—Any person or corporation arranging or offering to arrange for the transportation of property for compensation by any motor carrier over the highways of California.

MRT—Abbreviation designating minimum rate tariffs published by the Commission.

Mutual Water Company (Cooperative)—A private organization established to supply water to its members at cost. Mutuals are not regulated by the PUC.

N

NOI (Notice of Intent)

Net Operating Income (Results of Operations)—The amount of revenue from utility operations remaining after operation and maintenance expenses, depreciation expenses, and taxes attributed to the utility operation are deducted. The revenues and expenses that produce net operating income are commonly referred to as "above the line" items.

Nonutility Items—All items of revenue, expense and investment not associated, either by direct assignment or by allocation, with providing utility service.

Normalization of income taxes—An accounting procedure under which a company computes income taxes in its income statement using straight line depreciation, and in its income tax returns using accelerated depreciation. The difference between the two tax amounts is entered in a deferred tax account and is used to reduce income taxes reported in the income statements over the life of the related property. (See flow-through of income taxes.)

Notice of Intent (NOI)—Preliminary data tendered by a utility in preparation for the formal filing of a general rate increase application. (See page 8)

O

OCC (Other Common Carriers)

OCMS (Optional Calling Measured Service)

OII (Order Instituting Investigation)

OIR (Order Instituting Rulemaking)

ORTS (Optional Residence Telephone Service)

Off Peak Service—Service made available on special schedules or contracts on a firm basis but only for a specified time during the off-peak portion of the load cycle.

Offset—(See page 8)

Operating Ratio—The ratio of operating expenses to operating revenues. (See Expense Ratio)

Operating Right—The right granted to for-hire motor carriers to operate over certain routes or within certain areas or territories.

Operating Unit or System—A complete and self-sustaining power generating facility or group of facilities acquired and operated intact as a segment of a complete system.

Optional Calling Measured Service (OCMS)—Telephone service allowing residential customers outside the San Francisco and Los Angeles metropolitan areas to call over specified routes within a 40-mile radius at reduced rates.

Optional Residence Telephone Service (ORTS)—A telephone service allowing residents of the San Francisco, Los Angeles and Orange County metropolitan areas to call within a 40-mile radius at reduced rates. Measured rate service is available either to specific communities or to all communities within a specified circle.

Order Instituting Investigation (OII)—(See pages 6 and 15)

Order Instituting Rulemaking (OIR)—(See pages 6 and 15)

Original Cost—The actual cost of property to the party who first devoted it to public use as utility property.

P

PGA (Purchased Gas Adjustment)

Peak Demand—The maximum level of operating requirements placed upon the system by customer usage during a specified period of time (five-minute peak, fifteen-minute peak, thirty-minute peak, one-hour peak and one-day peak outputs are common points of reference). It may apply to an operating segment of the company, such as a customer class, or to the entire company, depending on intended use of the data.

Peak Load Pricing—A higher rate charged for a service during a peak demand period. A peak demand period is designated, and customers who use electricity during these hours pay a higher rate than they would during off-peak hours. Peak load pricing is designed to recover the higher costs associated with the less efficient generation used to meet peak demand.

Permit—Authority issued to carriers who by statute are not regulated as public utilities.

Petitioner—Any party who seeks to appeal a Commission decision, modify a proposed decision, or intervene during a Commission hearing.

Prehearing Conference—(See page 18)

Prime carrier—A certificated or permitted motor carrier that engages other carriers or subhaulers.

Private Line (Leased Line)—A telephone line permitting unlimited service between two points at a special rate and not connected to the regular telephone network. Private lines are available for data transmission and for use as fire and burglar alarm circuits, as well as for voice.

Proposed Decision—(See page 20)

Protestant—A party who files a protest to an application or other filing by another party.

Public Power—An electric utility owned by a government entity such as a municipality or utility district.

Purchased Gas Adjustment (PGA)—(See page 10)

Q

Qualifying Facility—A cogeneration facility or a small power production facility which is a qualifying facility under 18 CFR, Chapter I, Part 292, Subpart B of the FERC regulations. Small power producers include small hydroelectric, geothermal, biomass, waste-to-energy, wind and solar facilities.

R

RTU (Radiotelephone Utility)

Radial Highway Carrier—A for-hire motor carrier that formerly operated over regular routes between fixed points. This class of carrier was eliminated by Senate Bill 860 in 1978, and those carriers converted their radial permits to Contract or Common Carrier authority (See Section 1063.5 of the Public Utilities Code).

Radiotelephone Utility (RTU)—A regulated utility (generally small compared to telephone utilities) which provides two-way radio service and paging service.

Rate Base—The total of original cost of a utility's investment in operative property presently devoted to public service, minus the amount of accrued depreciation on such property, plus an allowance for working capital, plus or minus certain other items. This investment base is the amount to which the rate of return is applied.

Rate Bureau—An organization of trucking companies which together set rates that are then submitted to the Commission for approval. By statute rate bureaus are exempt from California antitrust laws.

Rate Structure—The various rates charged by a utility for its services.

Reregulation—Reform of regulations to meet present day circumstances.

Resale Telephone Carriers—Carriers who resell telephone service to individual customers but own a minimum of telephone facilities. Generally, the owned-plant consists of one switch in each city and all of the transmission lines are leased from the telephone utilities.

Reserve Margin—The amount of unused capacity (idle capacity) that a utility has at the period of peak demand.

Residual Fuel—A petroleum product burned by electric utilities as boiler fuel to generate electricity. It is composed of products remaining from crude petroleum after an appreciable percent of the more volatile hydrocarbons is removed.

Results of Operation—(See Net Operating Income)

Return—Rate of return times the rate base.

Return on Equity—The profit left to common shareholders after all expenses, interest costs and preferred stock dividends are paid. This amount is generally expressed as a percentage of common equity investment.

Revenue Requirements—The total revenue needed to pay all operating and capital costs of a business.

Rules of Practice and Procedure—The rules governing the way utilities, transportation companies, and the public conduct formal proceedings before the Public Utilities Commission. Available from Documents Section.

S

SAM (Supply Adjustment Mechanism)

SMRT (Single Message Rate Timing)

Scrubber—A device at an electric generating plant to remove air contaminants produced by burning fossil fuels.

Security Issues—(See page 11)

Separations (Communications)—The cost allocation procedures used in telephone ratemaking to divide a utility's expenses and investment in plant between interstate and intrastate jurisdictions.

Settlement (Communications)—The process by which two or more operating telephone companies divide revenues for jointly provided telephone service.

Shipper—The person or business for whom articles are transported.

Single Message Rate Timing (SMRT)—Pricing local telephone calls on a timed rather than flat rate basis.

Specialized Common Carrier (Communications)—A company offering telecommunications service between two or more points, to large volume users, using microwave or other advanced technology. SCCs offer high speed, large volume telecommunications services in competition with AT&T. They generally do not provide local circuits within the city ending at the customer's premises.

Statement—Unsworn view or opinion offered at a public hearing, made part of the file but not subject to cross-examination. (See page 19) (Also see Testimony)

Subhauler—A motor carrier that provides transportation for another carrier. (See Prime Carrier)

Submission—A proceeding is submitted for decision after all the evidence has been received, the briefs have been filed, and the oral argument has taken place. At this point the ALJ has before him everything he or she will need to write a proposed decision.

T

TEFRA (Tax Equity and Fiscal Responsibility Act of 1982)

TL (Truckload)

Tail Blocks—An open-ended rate block specifying the rate for all energy used over the prescribed amount.

Tariff—A document filed with the Commission by utilities specifying lawful rates, charges, rules and conditions of providing services to the public.

Testimony—A declaration, oral or written, given under oath at a public hearing and subject to cross-examination. (See Statement)

Therm—A unit of heat equal to 100,000 British thermal Units. Natural gas is usually measured in therms rather than cubic feet because gas from different sources may have different heating values.

Times Interest Earned—The number of times that utility income available for interest payments covers its bond interest payments. (Sometimes called "Times Interest Coverage")

Time-of-Use—A rate design that provides lower electric rates for consumers who use energy during off peak hours.

Truckload (TL)—Shipments in large lots (usually exceeding 10,000 lbs.) which occupy all, or a substantial portion of the capacity of a truck and trailer. (See less-than-truckload)

Two Tier—A two-part pricing concept. In communications, the first tier is based on fixed costs of the equipment and remains fixed for a given customer. The second tier reflects variable costs such as wages, maintenance expenses, etc. Two tier is also used to describe a utility rate structure with a lower charge for the first, or baseline quantity and a higher charge for usage over the baseline allowance. Some gas and electric rates in California are designed with three tiers as a stronger conservation incentive.

U

Unbilled revenues—Revenues earned by a utility through sales of energy to customers for which those customers have not yet been billed.

Undercharge—Any transportation charge based on a rate that is less than a filed tariff rate, or accepted reduced rate, or prescribed by the Commission in one of its minimum rate tariffs. The Commission staff may impose and collect from the carrier a fine which equals the amount of the undercharge.

V

Value of Service—A monetary measure of the usefulness or necessity of utility service to a customer group.

W

Wide Area Telephone Service (WATS)—A bulk rate for message toll telephone service offered both on an out-WATS and in-WATS basis. Out-WATS allows a customer toll calling to a specified area at WATS rates instead of toll rates. In-WATS permits any caller from a specified geographical area to call a specific customer who pays the charges at WATS rates.

Working Capital—Amount included in rate base in addition to utility plant. Usually includes (1) fuel inventory, and material and supplies inventory; and (2) an allowance for investor supplied funds (i.e., cash working capital) needed to pay operating expenses during the interval between the time that expenses are incurred and the subsequent period when revenue to cover the expenses is collected.

Z

ZIP (Zero Interest Program)—A program to provide loans, without interest, to residential customers to insulate or weatherize their homes.

ZUM (Zone Usage Measurement)—A method of pricing local calls and interexchange calls up to 16 miles between rate centers in the San Francisco and Los Angeles areas. Messages are timed in one-minute increments. Evening and night discounts of 35% and 60% apply.

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Competition, Pricing, and Regulatory Policy in the International Telephone Industry

Leland L. Johnson

RAND

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PREFACE

This report focuses on the characteristics of prices charged by international telecommunications carriers to their customers or "end users," and the arrangements by which carriers in separate countries compensate each other for handling portions of traffic that together permit end-to-end "retail" service. More specifically, the study examines the relationships between international telephone rates and the cost of service, the impediments to efficient pricing of telephone service, the effects of competition on prices and financial settlements among telephone carriers, and the implications for economic efficiency and government regulatory policy.

This report should be of interest to domestic and foreign telecommunications carriers, regulatory and legislative bodies, and the academic research community.

This work is funded under grants from the National Science Foundation (Dr. Laurence Rosenberg, project monitor) and from The Markle Foundation. Under these same grants, a companion report is being prepared by Jan Paul Acton and Ingo Vogelsang dealing with telephone demand over the Atlantic.

SUMMARY

This report focuses on the characteristics of prices charged by international telecommunications carriers to their customers or "end users," and the arrangements by which carriers in separate countries compensate each other for handling portions of traffic that together permit end-to-end "retail" service. International traffic constitutes about 14 percent of AT&T's telephone service. Because international traffic is growing more rapidly than is domestic, with a growth rate of about 20 percent annually, this sector will become progressively more important during the 1990s.

The telephone market is dominated by AT&T, but competitors such as MCI International (MCII) and US Sprint are gaining market share. Although in earlier years AT&T had essentially the whole international market, its revenue share for originating traffic had fallen to about 93 percent by 1987, with MCII and US Sprint accounting for about 5 percent and 2 percent, respectively.

For several reasons, retail service merits serious attention:

- International telephone rates have fallen markedly in response to technological advance, but they remain much higher than domestic long distance rates. The rapid decrease in transoceanic circuit costs raises questions about whether the differential is economically justified.
- The structure of international rates, involving differentials between peak and off-peak use in some cases but not in others, raises questions about whether these rates are designed appropriately to encourage efficient circuit use.
- The U.S. international telephone market is becoming increasingly competitive, while in most other countries a government owned "postal, telephone, and telegraph" entity, or "PTT," retains a monopoly of all service. This situation raises questions about whether monopoly foreign carriers are able to "whipsaw" U.S. competing carriers, by playing one off against the other, and thereby to capture for themselves much of the gain from competition among U.S. carriers.
- Telephone volume from the United States to most countries exceeds incoming traffic. Moreover, the disparity is growing. The ratio of originating to terminating minutes rose from about 1.3 in 1975 to more than 2.0 in 1987. This disparity led to a

net payments outflow (excluding Mexico and Canada) that grew from about $69 million in 1975 to nearly $1.4 billion in 1987. This figure now amounts to more than 1 percent of the U.S. balance of payments deficit.

To jointly provide end-to-end arrangements required to complete calls originating in the United States, and to handle incoming traffic, carriers must enter into cooperative arrangements. The "operating agreement" provides the technical details of interconnection and the terms for the settlement of accounts between U.S. carriers and PTTs. These agreements specify the payment to be made by the carrier that collects for the call to the other carrier that completes the call. Payments are made in accordance with the "accounting" rate, which generally is divided 50/50 between the two carriers. Thus, if the accounting rate per minute is $2.00 the originating carrier pays $1.00 per minute to its partner for completing the call. The *net* revenue to the originating carrier reflects the difference between its "collection" rate—the rate paid by its customers—and one-half of the accounting rate.

The accounting rate (divided by 2) is critically important for our purposes because it represents the per-minute marginal cost to the originating carrier of using the terminating carrier's network to complete an additional minute of traffic. Consequently, the higher the accounting rate, the higher the collection rate is likely to be.

THE OVERALL LEVEL OF PRICES

Although collection rates have fallen markedly, this study suggests that international revenues for AT&T and foreign carriers remain substantially above costs, with international service being quite lucrative. It examines AT&T's revenues for worldwide outgoing and incoming minutes of traffic in relation to AT&Ts cost estimates (in 1985) for handling this traffic, including a return on its investment in international service facilities. The study shows that over and above these costs, AT&T earned a "surplus" of 8 percent of total revenues.

For two reasons service is probably even more profitable for the PTTs: Their collection rates converted to U.S. dollars are generally higher than AT&T's, and high accounting rates benefit the PTTs because of the large net inflow of traffic from the United States. The study examines the situation for France, under the assumption that France's cost per minute of traffic is the same as that of AT&T. For a nine-minute outgoing call from France (the average length of a call), the French PTT is estimated to earn a surplus equal to 36 percent of

its total revenue—much higher than the 19 percent that this study estimates as the surplus earned by AT&T on its service with France.

Why is AT&T's international service permitted to earn such large returns? The immediate answer is that international services are not regulated separately from domestic offerings. Rather, international revenues and costs are merged with AT&T's other revenues and costs for services under the jurisdiction of the Federal Communications Commission (FCC) to determine whether AT&T's overall rate of return is in line with the rate of return authorized by the FCC. But why is international service not separately regulated? The answer is that the FCC may prefer that AT&T earn handsomely on its international service, because excess profits help to reduce domestic telephone rates. In response to public relations and political pressures, regulators are probably more concerned with rates to local, intrastate, and interstate users than they are with international. If so, regulators have no strong incentives to regulate international rates separately.

The situation in the United States is not wholly dissimilar from that in countries where government-owned PTTs are commonly alleged to make large profits on international services for the sake of supporting other services.

TIME-OF-DAY PRICING

Almost all the costs of supplying international service (as well as domestic service) are capacity costs. These are the costs embodied in the facilities required to handle a given peak volume of calls. This peak volume generally occurs during only a few hours of the day. The marginal cost of a call during times of excess capacity is virtually zero. To maximize social welfare from telecommunications services (i.e., to maximize the sum of consumer and producer surplus), prices should reflect the large difference in marginal cost between peak and offpeak periods.

Before 1982, AT&T had a two-period rate to some countries and a single-period rate to others. In response to technological advances, market growth, and other factors, AT&T undertook a major restructuring in 1982 with large rate cuts and adoption of three-period collection rates to all countries.

In contrast, many countries continue with only a single 24-hour rate for service to the United States. Of 99 countries with direct dial service to the United States in 1988, only 10 had a three-period structure, 31 had a two-period structure, and 58 had a single 24-hour rate. From 1979 to 1982 in Western Europe, a few countries such as Switzerland,

France, and Italy adopted a more differentiated time-of-day structure; but two others—West Germany and Netherlands—moved in the other direction.

Adoption of peak load prices is a slow process, with many PTTs resisting movement away from a single-period rate. Their behavior is probably explainable by the adverse effects they estimate that time-of-day pricing would have on their revenues.

Although determination of optimal time-of-day prices is far beyond the scope of this study, there is reason to conclude that economy rates, at least, are too high for traffic to Western Europe. Several impediments exist to improving rate structures. Perhaps the most notable is the existence of high accounting rates. AT&T, and other U.S. carriers, are willing to set economy rates below their payments for these calls to some PTTs (resulting in direct losses) because of offsetting gains elsewhere. But one must expect a limit beyond which the U.S. carriers are not willing to go without a reduction and adjustment in accounting rates.

Even though accounting rates have generally declined, and time-of-day rates have been adopted by a few countries, accounting rates generally remain far above marginal cost, at least during off-peak periods. Ideally, accounting rates should be set so that the per-minute outpayment by the originating carrier is equal to the per-minute marginal cost incurred by the receiving carrier for use of its network to complete the call. This cost varies by time of day depending on variations in traffic volume.

The emergence of competition among U.S. carriers creates dangers of whipsawing, which the FCC seeks to prevent by overseeing accounting rates. But accounting rates are only one of several tools that carriers can use in their negotiations. With or without uniform accounting rates, monopoly PTTs are in a strong position to extract concessions from U.S. carriers.

THE OUTFLOW OF DOLLARS

Recent increases in the net outflow of dollars may be evidence of the squeeze by foreign PTTs on competing U.S. carriers. These PTTs agree only to slow reductions in accounting rates, while competitive pressures on the U.S. side force larger reductions in collection rates.

However, growing dollar outflows also occurred when AT&T dealt with foreign carriers on a bilateral monopoly basis. Negotiations that benefit the participating carriers are not necessarily associated with a zero net dollar outflow. Net payments to PTTs are only one of several

factors that affect AT&T's earnings. Maximization of profit can be consistent with a large net outflow of dollars.

COMPETITION AND REGULATORY POLICY

The bargaining power of PTTs has notable limits. PTTs compete with each other for transit traffic to and from the United States. Investment in new satellite and cable systems will contribute to greater competition among PTTs by expanding the possibilities of alternative routings by U.S. carriers. These technologies may also help directly to break through PTT monopoly bottlenecks. The FCC can exploit these possibilities by eliminating the ban it now imposes on carriage of switched traffic by "separate" satellite systems (i.e., those that compete with the INTELSAT global satellite system). It has recently moved in the right direction by clarifying that "private" cables (i.e., those not owned by traditional monopoly common carriers) are free to be used for switched, common carrier traffic.

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CONTENTS

PREFACE iii

SUMMARY v

ACKNOWLEDGMENTS xi

FIGURES AND TABLES xv

Section

I. INTRODUCTION 1

II. THE INTERNATIONAL TELEPHONE INDUSTRY 4
- Market Structure and Growth 4
- Worldwide Distribution of Traffic 6
- Collection Rates and Accounting Rates 7

III. COLLECTION RATES, COSTS, AND PROFITS 12
- AT&T's Earnings Ratios 12
- Analysis of International Revenues and Costs 12
- Accounting Rates and the Cost of Network Use 18
- Government Regulation and Market Strategy 18
- Effects on Economic Efficiency 21

IV. TIME-OF-DAY PRICING 23
- Marginal Cost and Optimal Pricing 23
- The Motivations of Carriers 26
- Impediments to Improving Pricing Structures 28
- Summary 33

V. COMPETITION AND THE ROLE OF GOVERNMENT REGULATION 35
- Competitive Access by U.S. Carriers to Foreign Markets 35
- The Phenomenon of Whipsawing 39
- The Net Dollar Outflow 42
- Limitations on the Bargaining Power of PTTs 45
- Implications for U.S. Regulatory Policy 49
- Summary 51

VI. CONCLUSIONS 52

Appendix: DIRECTIONS FOR FUTURE RESEARCH 55
BIBLIOGRAPHY 61

FIGURES

4.1. Twenty-four-hour traffic profile, United States and Europe 24
4.3. AT&T collection rate to West Germany, 1979–1988 25
4.3. Traffic profile and rate periods, United States and Europe 29
5.1. Traffic and dollar flows 43

TABLES

2.1. Percent market shares of U.S. international telephone carriers 4
2.2. U.S. international traffic, 1975–1987 5
2.3. Distribution of international telephone calling, 1987 6
2.4. AT&T revenues from switched services, 1987 7
2.5. Percentage decrease in AT&T collection rates and in dollar accounting rates, 1979–1988 9
2.6. Percentage decrease in AT&T collection rates and in SDR accounting rate, 1980–1988 9
2.7. Real percentage changes in collection rates, five-minute direct dialed call 10
2.8. Collection rates, five-minute direct dialed call, converted to U.S. dolars, 1987 11
3.1. AT&T earnings ratios: international telephone service 13
3.2. AT&T revenues and costs, service with France, 1985 14
3.3. AT&T revenues and costs, service with all countries, 1985 15
3.4. PTT revenues and cost per nine-minute outbound call, France to United States, 1985 16
3.5. Comparison of assumed PTT costs and payments by AT&T, 1985 19
4.1. Rate structures for telephone service to the United States 26
4.2. AT&T revenues and payments to PTTs, direct dial economy rate, five-minute call, 1988 32
5.1. U.S. carrier tariffs, five-minute direct dial, 1987 38

5.2. U.S. balance of payments deficit for international telephone service, 1987 44
5.3. Telephone rates: direct and indirect routing five-minute direct dial, 1987 47

I. INTRODUCTION

The bulk of public policy analysis in the international telecommunications arena has focused on the technical and economic aspects of transoceanic transmission. The development of communications satellites in the mid-1960s and the extraordinary growth of global satellite communications since that time have captured worldwide attention. The substitution of coaxial underseas cable for radiotelephone, starting in the late 1950s, represented an enormous leap forward in circuit capacity and service quality.[1] The development of underseas fiber optic cable, with the first such cable completed in late 1988 across the Atlantic, substitutes digital for analog transmission and drastically reduces per-circuit cost.

In response to such developments, much attention has been devoted to the institutional arrangements, and the related public policy issues, for supplying international services.[2] Especially, the establishment in 1965 and the subsequent growth of the International Telecommunications Satellite Organization (INTELSAT) have been subject to much analysis because of its importance in providing a global network of satellite links. The role of the Communications Satellite Corporation (COMSAT) as the U.S. representative to INTELSAT and the monopoly supplier of INTELSAT circuits to U.S. users has similarly attracted attention.

Much less analysis has been devoted to the characteristics of prices charged by telecommunications carriers to their customers or "end users," and the arrangements by which carriers in separate countries compensate each other for handling portions of traffic that together permit end-to-end "retail" service.[3] This situation stands in contrast to the extensive attention paid to the "wholesale" market for satellite and cable circuits noted above.

Retail service is obviously important because the benefits that consumers enjoy from technological advances depend on the prices they

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[1]For a succinct description of the dramatic advances in satellite technology and reductions in circuit costs, see INTELSAT (1988). Reductions in cable circuit costs are estimated in FCC (1988e), p. 12.

[2]See, for example, Johnson (1987, 1988a, 1988b), Kwerel and McNally (1986), Miglio (1987), President's Task Force on Communications Policy (1968), and, especially, Snow (1988) who surveys and provides extensive cites to the international (as well as to the domestic) literature.

[3]Among the few studies are Dansby (1983), Dansby and Luciano (1987), Kwerel (1984, 1987), O'Brien (1988, 1989), and the FCC (1988e).

pay. Even a radical technological advance that reduced transoceanic circuit costs to zero would be of limited consequence to consumers unless prices fall accordingly. For several reasons the economics of retail service merit serious attention:

- Although international telephone rates have fallen in response to technological advance, they remain much higher than domestic long distance rates. The rapid decrease in transoceanic circuit cost raises questions about whether the differential is economically justified.
- The structure of international rates, involving differentials between peak and off-peak use in some cases but not in others, raises questions about whether these rates are designed appropriately to encourage efficient circuit use.
- The U.S. international telephone market is becoming increasingly competitive, while in most other countries a government owned "postal, telephone and telegraph" entity, or "PTT" retains a monopoly of all service.[4] This situation raises questions about whether monopoly foreign carriers are able to "whipsaw" U.S. competitive carriers, by playing one off against the other, and thereby to capture for themselves much of the gain from competition among U.S. carriers.
- Telephone volume from the United States to most countries exceeds incoming traffic. Moreover, the disparity is growing. The ratio of originating to terminating minutes rose from about 1.3 in 1975 to more than 2.0 in 1987. This disparity led to a net payments outflow (excluding Mexico and Canada) that grew from about $69 million in 1975 to nearly $1.4 billion in 1987.[5] For Mexico, the net outflow ran to an additional $313 million in 1987, while a net *inflow* of $19 million was recorded for Canada.[6] This rapidly growing net outflow now exceeds 1 percent of the U.S. balance of payments deficit.

This study seeks to enhance our understanding of how international telephone rates are established, how the financial settlements process

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[4]Important exceptions are (a) the United Kingdom, where British Telecom, spun off from the British Post Office in 1981 and privatized in 1984, competes with Mercury Communications for both domestic and international traffic, and (b) Japan, where competition is emerging with KDD, which earlier held a monopoly of international service in Japan. For a comprehensive discussion of developments in the United States, Canada, United Kingdom, Federal Republic of Germany, France, Finland, and Japan, see Bruce et al. (1986).

[5]FCC (1988d), p. 13. Unless otherwise stated, all dollar figures in this study are stated in current, as distinguished from constant or real, magnitudes.

[6]FCC (1988e), pp. 20, 21.

among carriers operates, what the impediments are to competition in the international arena, and what effects competition is likely to have on prices and services. Accordingly, the study addresses the preceding four areas of policy concern and explores the implications for U.S. regulatory policy.

Because the study addresses a complex area that has received little analytical attention, the study can do little more than skim the surface of many topics. Another purpose of the study, then, is to delineate briefly topics that merit more detailed and rigorous research.

Section II discusses the nature of the international telecommunications industry as background for the analysis in subsequent sections. It examines the growth of the industry, differentiating between telephone, telex, and telegraph services; describes the emergence of competition among U.S. telephone carriers; and discusses the financial settlements process with foreign carriers required for end-to-end service.

Section III addresses concerns that international rates are too high. Using AT&T's cost estimates for international service, it examines the profitability of international service for U.S. carriers and (using the example of France) for the PTTs of major industrialized countries. It then traces the effects on economic efficiency.

Section IV examines time-of-day pricing designed to make more efficient use of international facilities. After describing the evolution of price structures during the present decade, it explores the motivations of carriers to adopt, or to decline to adopt, time-of-day pricing. Especially important, it demonstrates how the arrangements for financial settlements among carriers impedes adoption of more economically efficient price structures.

Section V examines the growth of competition among U.S. carriers and how the bargaining power of these carriers may be weakened in relation to monopoly PTTs with which they must deal. It treats the FCC's regulatory tools designed to protect against this shift in bargaining power and discusses appropriate future directions for FCC action.

The appendix describes several directions for needed future research.

Throughout, we will be primarily concerned with countries other than Mexico and Canada. This limitation arises because arrangements among carriers are different for these two countries, and less traffic data are available for Mexico and Canada.[7]

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[7]For a discussion of these differences for Canada and Mexico, see Stanley (1988), p. 3.

II. THE INTERNATIONAL TELEPHONE INDUSTRY

MARKET STRUCTURE AND GROWTH

The international telecommunications market includes "voice" carriers that provide telephone service and "record" carriers that primarily provide telex and other hard-copy services.[1] Although the voice or telephone market is dominated by AT&T, competitors such as MCI International (MCII) and US Sprint are gaining market share. Although in earlier years AT&T had essentially the whole switched market, its revenue share for originating traffic had fallen to about 93 percent by 1987, with MCII and US Sprint accounting for about 5 percent and 2 percent, respectively, shown in Table 2.1.

The record industry has a more competitive structure than the voice market, with some half-dozen major players. The largest—RCA Global Communications and ITT Worldcom—each had about a 30 percent market share in 1987. But the industry is witnessing extensive merger activity. With two recent acquisitions—RCA with Western Union International, both acquired by MCI, and ITT Worldcom acquired by

Table 2.1

PERCENT MARKET SHARES OF U.S. INTERNATIONAL TELEPHONE CARRIERS

Carrier	1985	1986	1987
AT&T	98.6	95.0	92.9
MCII	1.1	3.8	4.8
US Sprint	0.2	1.2	1.9
TRT Communications	0	0	0.1
Others	0	0	0.3

SOURCE: FCC (1988d), p. 24.

[1]Because more than 99 percent of international telephone revenues come from "message" or "switched" services, with the remainder from private line offerings, all references in this study to telephone service will be confined to switched services. These include public message service, WATS, "800" service, and similar offerings.

Western Union Telegraph—these two groups hold about 85 percent of the record market.[2]

The telephone industry is much larger and is growing faster than the record industry. Table 2.2 shows an annual average growth rate of 24 percent in telephone minutes—a twelvefold increase between 1975 and 1987. No less striking is the nearly 50 percent reduction in the average revenue per minute, reflecting rate reductions and the growing use of direct distance dialing. Telex has grown much more slowly and has suffered declines in both minutes and revenues since 1985. This situation reflects growing competition from other services—especially facsimile transmission that, using ordinary telephone lines, permits direct hard-copy communication. The telegraph market has been declining for years, reflecting the emergence of superior alternatives. Unfavorable market developments and declining profits in the record field are largely responsible for the merger movement noted above. Because the telephone sector is far larger and is growing faster than telex and

Table 2.2

U.S. INTERNATIONAL TRAFFIC, 1975–1987

Type of Traffic	1975	1987	Average Annual Change, %
Telephone			
Minutes (millions)	375.3	4,723.3	24
Revenue per minute from U.S.	$2.25	$1.16	−6
Telex			
Minutes (millions)	123.2	335.3	9
Revenue per minute from U.S.	$2.83	$2.30	−2
Telegraph			
Words (millions)	511.3	160.1	−10
Revenue per word from U.S.	$0.17	$0.35	6

NOTE: Minutes and words include both inbound and outbound traffic. Figures exclude Mexico and Canada. Revenue per minute from U.S. outbound traffic computed by dividing total revenues from U.S. outbound traffic by total minutes of U.S. outbound traffic.

SOURCE: FCC (1988d), p. 12.

[2]FCC (1988d) p. 8.

telegraph combined, this study will be confined primarily to telephone service.[3]

WORLDWIDE DISTRIBUTION OF TRAFFIC

Table 2.3 shows the distribution of telephone traffic to and from the United States. Not surprisingly, Canada and Mexico together loom prominently, followed by major West European countries and Japan. But a few smaller countries, such as Colombia and the Dominican Republic, also rank high.

International traffic constitutes about 14 percent of AT&T's telephone service, shown in Table 2.4. Because international service is growing more rapidly than is domestic, we can expect the international sector to become progressively more important during the 1990s.

Table 2.3

DISTRIBUTION OF INTERNATIONAL TELEPHONE CALLING, 1987
(Millions of minutes)

Market	Originating in U.S.	Terminating in U.S.
Canada and Mexico	1,326	1,121
Ten largest markets outside North America		
United Kingdom	421	305
West Germany	307	136
Japan	180	108
France	119	83
Italy	112	56
Colombia	95	31
Korea	92	25
Dominican Republic	90	21
Australia	56	51
Taiwan	73	30
Total top ten	1,545	848
Rest of world	1,623	739
Total international	4,494	2,708

SOURCE: FCC (1988e), p. 15.

[3]In 1987, the telephone carriers had gross revenues of over $5 billion (excluding Canada and Mexico), compared with less than $600 million for the record carriers. FCC (1988c), pp. 17, 172. These figures include revenues from originating traffic and from terminating traffic originating in other countries.

Table 2.4

AT&T REVENUES FROM SWITCHED SERVICES, 1987

Type of Call	Revenues (Billions)	Percent of Total
Calls to Canada and Mexico	$ 0.9	3
Calls to other foreign countries	3.4	11
Interstate calls	19.6	62
Intrastate calls	7.8	24
Total	$31.7	100

NOTE: Revenues are amounts billed by AT&T to its customers. They do not include payments to AT&T from foreign correspondents.
SOURCE: FCC (1988e), p. 10.

COLLECTION RATES AND ACCOUNTING RATES

To jointly provide end-to-end arrangements required to complete calls originating in the United States, and to handle incoming traffic, carriers must enter into cooperative arrangements. The "operating agreement" provides the technical details of interconnection and the terms for the settlement of accounts between U.S. carriers and foreign PTTs. These agreements specify, among other things, the payment to be made by the carrier that originates a call to the other carrier for terminating the call. Payments are made in accordance with the "accounting rate," which generally is divided 50/50 between the two carriers. Thus, if the accounting rate per minute is $2.00 the originating carrier pays $1.00 per minute to its partner for completing the call. The net revenue to the originating carrier reflects the difference between its "collection" rate—the rate paid by its customers—and one-half of the accounting rate.

Collection rates are set by carriers in their own currencies. Accounting rates are denominated in dollars, gold francs, or special drawing rights (SDRs).[4] The accounting rate, and in some cases the collection rate, are subjects of negotiation between the carriers.

Frequently, the originating carrier's net revenue is small because the collection rate is not much higher than one-half of the accounting rate. Indeed, the net revenue of U.S. carriers can be negative. For example,

[4]SDRs, established under auspices of the International Monetary Fund, are based or exchange rates for U.S., West German, British, French, and Japanese currencies. In January 1989 one SDR was equal to about $1.32.

in 1986 the average per-minute revenue to U.S. carriers for calls to Brazil was $1.17 but their payment to Brazil was $1.25.[5]

More than offsetting these losses are the revenues that U.S. carriers receive for terminating traffic that originates in the other country. The negative revenue of $1.6 million to U.S. carriers for traffic to Brazil in 1986 was less than the $33.6 million they earned from Brazil.

The reader might easily conclude from the above that were outgoing and incoming traffic perfectly balanced for the country in question, the accounting rate would be irrelevant. Regardless of the level, each carrier would keep the amount it receives from customers (in local currency) as determined by the collection rate. However, even for balanced traffic the accounting rate is far from irrelevant. For each per-minute increase (or decrease) of originating traffic, the originating carrier pays (or saves) an amount equal to one-half the accounting rate. Thus, one-half of the accounting rate is the cost to the originating carrier of using the terminating carrier's network to complete the call. Since one-half of the accounting rate is part of each carrier's marginal cost, high accounting rates encourage high collection rates, possibly leading to a social welfare loss, regardless of relative traffic flows.

Moreover, as noted in Sec. I, telephone traffic is not balanced and the imbalance is growing rapidly. Because of the imbalance and high accounting rates, the profits of U.S. telephone carriers depend heavily on revenues from the inflow of traffic. In contrast, the record carriers generally receive more traffic than they originate. Thus, their net revenues are favorably affected by high accounting rates.

Collection and accounting rates have been falling for most countries, but accounting rates have fallen more slowly. Table 2.5 shows the pattern for 1979–1988 for a number of countries with which accounting rates are denominated in dollars. In all cases, collection rates have fallen faster. For countries whose accounting rates are denominated in SDRs, changes depend on fluctuations in the currency exchange rate. For a number of these countries, shown in Table 2.6, accounting rates converted to dollars have fallen more slowly than have collection rates. These patterns are relevant for examining the outcomes of negotiations between U.S. and foreign carriers and the effects on the U.S. balance of payments, discussed in Sec. V.

Two other aspects are notable. First, collection rates in both directions have fallen substantially in real terms. Table 2.7 illustrates the situation for selected European countries. For example, the peak period price from the United States to the United Kingdom fell 48 percent during 1979–1986, but the reverse rate fell 50 percent. Among the

[5]FCC (1987), p. 16.

Table 2.5

PERCENTAGE DECREASE IN AT&T COLLECTION RATES AND IN DOLLAR ACCOUNTING RATES, 1979–1988

Country	Collection Rate	Accounting Rate
Colombia	38	24
Hong Kong	34	6
Ireland	24	17
Israel	47	20
Japan*	45	22
South Korea	40	16
Philippines	40	32
Saudi Arabia	53	0
Taiwan	40	11
United Kingdom	34	12
Venezuela	49	35

NOTE: Direct dial, standard rate, each additional minute
SOURCE: Compiled from Stanley (1988), Appendix H.
*For Japan, 1979–1987.

Table 2.6

PERCENTAGE DECREASE IN AT&T COLLECTION RATES AND IN SDR ACCOUNTING RATE, 1980–1988

Country	Collection Rate	Accounting Rate (Converted to $)
Denmark, Finland, Norway, Sweden	37	19
France	48	6
West Germany, the Netherlands	48	19
Switzerland[a]	19	16

NOTE: Direct dial, standard rate, each additional minute.
SOURCE: Compiled from Stanley (1988), Appendix H.
[a]1981–1988.

countries listed, only Spain shows a substantially smaller reduction than the United States during the peak period. During the lowest priced period, the United Kingdom and Spain show smaller reductions than does the United States.

Second, even though the collection rates of PTTs for service to the United States have fallen, foreign rates generally are higher (when converted into dollars) than are the rates from the United States to these

Table 2.7

REAL PERCENTAGE CHANGES IN COLLECTION RATES, FIVE-MINUTE DIRECT DIALED CALL

Country Pairs	Years	Highest Price Period	Lowest Price Period
United States—United Kingdom	1979–86	−48	−67
United Kingdom—United States		−50	−47
United States—West Germany	1979–87	−58	−45
West Germany—United States		−68	−66
United States—France	1980–87	−54	−60
France—United States		−64	−78
United States—Spain	1979–87	−58	−54
Spain—United States		−37	−42
United States—Sweden	1979–87	−58	−54
Sweden—United States		−56	−57
United States—Switzerland	1979–87	−58	−63
Switzerland—United States		−69	−82

SOURCES: Eurodata Foundation (1979–1987); FCC (1987).

countries. The disparity tends to increase with the length of the call.[6] Table 2.8 compares a five-minute call during the highest and lowest priced periods. Of course, these comparisons are affected by fluctuations in dollar exchange rates. But earlier data from 1981 show similar patterns, suggesting that foreign collection rates, at least for Western Europe, are persistently higher.[7]

With this background discussion completed, we now examine the level of collection rates relative to the cost of service.

[6]For very short calls, the rates to the United States from some countries are lower than the reverse rates because the calls are timed on a per-second rather than on a per-minute basis.

[7]Kwerel (1987), Tables 6 and 7.

Table 2.8

COLLECTION RATES, FIVE-MINUTE DIRECT DIALED CALL CONVERTED TO U.S. DOLLARS, 1987

	Highest Price AT&T	Highest Price Foreign	Lowest Price AT&T	Lowest Price Foreign
United Kingdom (British Telecom)	5.78	6.08	3.49	4.74
West Germany	6.49	10.20	3.87	10.20
France	6.49	7.75	3.87	4.73
Italy	6.49	15.97	3.87	12.92
Spain	6.49	16.81	3.87	11.52
Sweden	6.49	7.68	3.87	5.91
Switzerland	6.49	10.73	3.87	8.04

SOURCE: FCC (1988a), pp. 5–7.

III. COLLECTION RATES, COSTS, AND PROFITS

Although collection rates have fallen, as shown in Tables 2.5 and 2.6, analysis here suggests that international revenues for AT&T and foreign carriers remain substantially above costs, with international service being quite lucrative. This section estimates differences between revenues and costs and presents evidence that accounting rates are substantially above the costs of network use. It explains why regulatory policy has permitted much higher returns on international traffic than on domestic traffic, and discusses the effects on economic efficiency.

AT&T'S EARNINGS RATIOS

As a first step in examining the profitability of international service, we draw from AT&T estimates of its earnings ratios on international service, shown in Table 3.1. (Unfortunately, these figures are available only through 1984.) All the figures are higher than AT&T's overall FCC-authorized rate of return that generally is set in the neighborhood of 12 percent (at this writing 12.2 percent).

However, these earnings ratios are only approximations to AT&T's rate of return, which is estimated only after regulatory review and adjustments to company-supplied data. As an alternative way to examine profitability in the absence of rate of return data, and to gain a better understanding of the role of financial settlements among carriers, we must turn to more detailed cost and revenue analysis.

ANALYSIS OF INTERNATIONAL REVENUES AND COSTS

A key ingredient of this analysis is AT&T's estimate of its "fully distributed cost" (FDC) for international service with each of a number of countries. AT&T does not routinely disseminate this information, but it did provide the FCC with a forecast of its international FDC for 1985. In the words of the commission:

> AT&T's estimates of fully distributed costs for 1985 include access charges to AT&T, AT&T's costs associated with the use of its domestic switched network to provide international service, and AT&T's costs for dedicated international trunk facilities. The cost categories include operating and maintenance expenses, depreciation,

Table 3.1

AT&T EARNINGS RATIOS: INTERNATIONAL TELEPHONE SERVICE

Year	Earnings Ratio (percent)
1977	15.5
1978	23.0
1979	36.5
1980	32.7
1981	25.0
1982	16.4
1983	14.2
1984	20.9

NOTE: The earnings ratio is defined as after-tax operating income plus interest charged to construction, all divided by undepreciated plant including plant under construction.
SOURCE: FCC (1988d), p. 9.

administrative and overhead costs, and an allowance for a return on net investment.[1]

Since FDC includes the administrative costs for overseas service and whatever other items are unique to the international arena, the estimates reflect an overall average historical cost of providing international service.

For each country, the FCC divides the total estimated FDC by the total number of outbound and inbound minutes to get an average per-minute figure. The estimates for Canada and Mexico run to $0.25 and $0.24, respectively, and the average for the top 10 other markets,

[1]FCC (1988e) p. 38. FDC methodology has been roundly criticized by economists and others because (a) it includes an allocation, necessarily arbitrary, of common costs among the firm's multiple services, and (b) it accounts only for historical costs rather than forward-looking incremental costs. However, problems of common cost allocation between domestic and international are less severe than elsewhere (e.g., allocating costs between WATS and domestic public message toll), because much of the cost for international service can be directly attributed to that service. The inclusion of historical costs is useful here to determine whether the firm is meeting its revenue "requirements"—as conventionally defined by regulators as revenues sufficient to cover the total cost incurred by the firm. Issues of incremental costs and appropriate pricing are treated in Sec. IV.

shown in Table 2.3, ranges from $0.35 to $0.53.[2] Using AT&T's FDC forecast for 1985, let us estimate AT&T revenues and costs for service with one country—France as an arbitrary selection—and for aggregate international service (excluding Canada and Mexico). Table 3.2, for service between the United States and France, shows total revenues of $155.1 million. The FDC figure of $58.3 million is estimated by multiplying the total number of outgoing and incoming minutes by $0.40 estimated by AT&T as its per-minute FDC for France. Payments to France for terminating traffic originating in the United States were $66.9 million.

The striking characteristic of Table 3.2 is the substantial remainder—$29.9 million or 19 percent of AT&Ts gross revenue—after all costs have been accounted for, including allowance for AT&T's return on investment embedded in its estimate of FDC. One can only conclude that service with France is extraordinarily lucrative for AT&T, at least as shown by 1985 data. Even though AT&T received less from France ($50.8 million) than it paid to France ($66.9 million) as a consequence of a high accounting rate and the imbalance of traffic, it came out far ahead when other revenues and costs are included.[3]

Table 3.2

AT&T REVENUES AND COSTS, SERVICE WITH FRANCE, 1985
(Millions of dollars)

Revenue		
Outbound service		$104.3
Inbound service		$50.8
Total		$155.1
Less		
AT&T FDC	$58.3	
Payments to France	$66.9	
Total		$125.2
Remainder		$ 29.9
Percentage of total revenue		19%

SOURCE: Computed from FCC (1986), p. 23; FCC (1988d), p. 37.

[2]FCC (1988e), pp. 36–37.

[3]If we assume that the cost components directly attributable to international service have been computed accurately, the FDC estimate will generally be higher than AT&T's average incremental cost by the amount of common cost allocated to international service. If average incremental cost is lower than the FDC estimates shown above, international service is even more profitable than suggested here.

Of course, one might argue that France is not a representative case. One would expect traffic on high density North Atlantic routes to be more profitable than that on low density routes to remote areas. Perhaps after taking into account service to such areas, AT&T's overall "remainder" drops to zero.

Table 3.3 addresses this possibility by examining AT&T's worldwide traffic characteristics, using the same methodology as Table 3.2. It shows that the remainder of $284.3 million as a percentage of total revenues—8 percent—is indeed lower than the 19 percent calculated for France. But it is still far from zero.

The conclusion is inescapable that, taking together high density and low density routes, international service was quite lucrative for AT&T in 1985.

For two reasons, one could conjecture that service must be even more profitable for the PTTs. First, their collection rates converted to U.S. dollars are generally higher than AT&T's, as noted in Sec. II, and these higher prices would lead to greater revenues (if the price elasticity of demand for service is less than one). Second, high accounting rates benefit the PTTs because of the large net inflow of traffic from the United States.

We test this possibility by using data, again for France, shown in Table 3.4. Because data are not available for local currency receipts by France for outgoing calls, the methodology in Table 3.4 is different from the preceding. Here we consider a weighted average revenue for a

Table 3.3

AT&T REVENUES AND COSTS, SERVICE WITH ALL COUNTRIES, 1985
(Millions of dollars)

Revenue		
Outbound service		$2,700.7
Inbound service		$1,035.9
Total		$3,736.6
Less		
AT&T FDC	$1,516.4	
Payments to other countries	$1,935.9	
Total		$3,452.3
Remainder		$284.3
Percentage of total revenue		8%

SOURCES: Computed from FCC (1986), p. 29; FCC (1988) p. 36. Excludes Mexico and Canada.

nine-minute call, which is the average length of a call from France to the United States. The weighted average is computed by taking collection rates in France, which vary by time of day (day, evening, and night) and type of call (direct dial, station, and person) weighted by the percentage breakdown by time of day and type of call for the aggregate of calls that terminate in the United States from all countries.[4]

The resulting figure converted from francs is $15.82. Revenue to France from AT&T is computed on the basis of the number of minutes of inbound traffic from the United States associated with the average nine-minute outbound call from France. The ratio of inbound to outbound U.S. traffic of 1.48 recorded for France in 1985, combined with an average $0.77 per-minute payment by AT&T to France for completing AT&T's outbound calls, gives a figure of $10.26 (from 1.48 × 9 × 0.77).

Because direct estimates of France's FDC are not available, we assume that France's FDC is the same as AT&T's—an average of $0.40 for each outgoing and incoming minute. This assumption suffices as a

Table 3.4

PTT REVENUES AND COST PER NINE-MINUTE OUTBOUND CALL, FRANCE TO UNITED STATES, 1985
(Millions of dollars)

Revenue		
Outbound service		$15.82
Inbound service		$10.26
Total		$26.08
Less		
PTT FDC	$8.93	
Payments to United States	$7.74	
Total		$16.67
Remainder		$9.41
Percentage of total revenue		36%

SOURCES: Time-of-day traffic from unpublished FCC material for 1984; collection rates from Stanley (1988), p. 92. Traffic flow from FCC (1987), p. 22.

[4]These characteristics of aggregate incoming traffic are drawn from FCC unpublished 1984 data, the latest year reported by the FCC. The calculations are based on the assumption that the composition of incoming traffic from France is the same as the composition of the total from all countries. An average length of call, instead of a per-minute figure, is used for France because the price of the first minute of calling is greater for direct dial, station, and person calls than for additional minutes.

rough approximation because of two factors that at least partially offset each other.

First, we would expect France's FDC to be higher than AT&T's because administrative costs (such as negotiating and overseeing operating agreements) must be spread over fewer total minutes for France than for the United States with its far larger traffic volumes. Other scale economies would also reduce per-minute costs for the United States.

If these economies were strong, however, we would expect countries with relatively small traffic volumes to have relatively high accounting rates with the United States, to reflect the relatively high per-minute marginal cost of handling incoming calls. For Western Europe, at least, no clear negative relationship exists between size of traffic volume and accounting rates. In 1988, Denmark, Sweden, Norway, Austria, Switzerland, and Finland all had a lower accounting rate with AT&T than did France, while Belgium and Luxembourg had the same rate as France.[5] As discussed below, accounting rates are affected by a complex of forces, with underlying costs being only one.

Second, we would expect France's FDC to be lower than AT&T's because the cost of handling incoming traffic is lower than the cost of handling outgoing traffic, and the ratio of U.S. incoming to outgoing traffic is higher for France (and for virtually all other countries) than for the United States.

Incoming traffic is less expensive to handle than outgoing traffic for two reasons. First, operator costs for handling station and person calls, along with selling expenses, billing, collection, and fraud, fall on outgoing calls rather than incoming calls. Second, the cost of incompleted calls falls disproportionately on the originating network, depending on where blockages occur.[6]

The FCC's estimate of AT&T's FDC is an overall average per minute for incoming and outgoing traffic for each country. AT&T's total FDC is affected by the ratio of outgoing to incoming traffic, since the costs differ for handling these two types of traffic, as explained above. For traffic with France this ratio was 1.48 as noted above. For France, in contrast, the ratio of outgoing to incoming traffic involving the United States was 0.68. This difference in composition lowers

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[5]Stanley (1988) p. 49.

[6]For example, if the blockage occurs at the gateway to transoceanic cable or satellite facilities, the originating national network would bear the cost of the incompleted call, since it would not reach the terminating country's facilities. The assumption that overall per-minute costs are about the same for the PTT and AT&T is strengthened by the fact that PTTs and AT&T generally share the costs of overseas circuits 50/50. For example, AT&T owns cable circuits to the hypothetical midpoint in the Atlantic, and its partners own the portion of circuits from that point to Europe.

France's FDC relative to AT&T's, because a larger portion of France's traffic constitutes incoming calls that are fairly inexpensive to handle.

With the assumption that, on balance, France's FDC is the same as AT&T's, the FDC of $8.93 is subtracted along with payments to the United States of $7.74 in Table 3.4.[7] This table suggests that indeed international traffic is even more lucrative, at least for France, than for AT&T. The remainder of $9.41 amounts to 36 percent of total revenues—much higher than AT&T's remainder of 19 percent on its service with France.

ACCOUNTING RATES AND THE COST OF NETWORK USE

AT&T's estimate of its per-minute costs also provides evidence that accounting rates are substantially higher than the cost of network use. Column 1 of Table 3.5 shows the assumed PTT costs—equal to AT&T's estimate of its per-minute cost for the 10 largest markets for telephone service with the United States. Column 2 shows the average per-minute payment by AT&T to complete its originating calls. Table 3.5 shows that AT&T pays out much more per minute to complete a call in each of the countries listed than the costs that the country incurs to complete the call. For Korea, as the extreme case, the payment is more than three times greater than estimated cost. The problems posed by such high payments (reflecting accounting rates) for economic efficiency are discussed below.

GOVERNMENT REGULATION AND MARKET STRATEGY

Why is international service permitted to earn such large returns? Since AT&T is regulated by the FCC, with its overall rate of return on interstate and international investment limited to a "fair" level (generally in the neighborhood of 12 percent), how it is able to earn such large amounts illustrated above? There are two answers—an immediate one and a more basic, probable one.

The immediate answer is that international services are not regulated separately from domestic offerings with respect to rate of return.

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[7]Payment of $7.74 is equal to nine minutes times $0.86—the average per-minute charge paid by France to AT&T in 1985. The figure of $0.86 is not equal to the $0.77 average that AT&T paid to France despite the 50/50 split in the accounting rate (which was 1.6 SDRs in 1985). Disparities between actual payments arise because of fluctuations in SDR exchange rates during the year, surcharges and other adjustments for handling collect calls, adjustments from preceding years, and other factors.

[8]We assume that the overall average per-minute cost to each foreign country is equal to those for AT&T, for the same reasons discussed above with respect to France.

Table 3.5

COMPARISON OF ASSUMED PTT COSTS AND PAYMENTS BY AT&T, 1985
(In dollars per minute)

	(1) Assumed PTT Costs	(2) Payment by AT&T	(3) Column 2 Divided by Column 1
United Kingdom	0.37	0.48	1.3
West Germany	0.37	0.60	1.6
Japan	0.41	1.22	3.0
France	0.40	0.77	1.9
Italy	0.41	0.88	2.1
Colombia	0.53	0.95	1.8
Korea	0.42	1.53	3.6
Dominican Republic	0.35	0.70	2.0
Australia	0.44	0.74	1.7
Taiwan	0.43	1.00	2.3

SOURCE: FCC (1988c), Table 19, and FCC (1986), Table 4.

Rather, international revenues and costs are merged with AT&T's other revenues and costs for services under FCC jurisdiction. Because international service is only a moderate portion of AT&T's total (shown in Table 2.4), high earnings in this sector are only one of many factors that affect AT&T's overall rate of return. Undoubtedly, among AT&T's regulated services some are "normally" profitable, others are quite lucrative, and yet others operate at losses.

Moreover, because of competitive pressures since divestiture, AT&T has not been able to earn even its overall authorized rate of return. The authorized level was prescribed by the FCC in 1986 at 12.2 percent. But AT&T recorded an actual rate of only 10.2 percent in 1984; 11.8 percent in 1985; 11.3 percent in 1986; and 11.2 percent in 1987.[9] Today, with the rate of return constraint not binding, AT&T is free to seek to maximize its profits for international service as well as for others.

But competitive pressures are a recent event. AT&T's international service was profitable long before the divestiture when it was easily able to earn its authorized rate of return.

[9]AT&T, *Fully Distributed Cost Report . . .*, (1985–1988).

Thus, the question remains as to why international service has not been separately regulated. The probable answer is that regulators prefer that AT&T earn handsomely on its international service, because excess profits help to reduce domestic telephone rates. In response to public relations and political pressures, regulators are probably more concerned with rates to local, intrastate, and interstate users than they are with international. These pressures arise from the fact that the benefits of reductions in international rates go partially to foreigners (through the increase in incoming calls to them) but the benefits of reductions in domestic rates are internalized. In response, regulators have less incentive to regulate international rates separately.

This is not to say that the FCC is indifferent to the level of international rates. In specific instances, it has exerted pressure on AT&T to reduce rates as a condition of FCC approval required for investment specific in international facilities. Moreover, in requiring COMSAT to reduce its satellite circuit rates to AT&T and other carriers after a lengthy rate investigation, the FCC sought to require these carriers to flow through their cost savings to their customers.[10] However, this ad hoc process of encouraging international rate reductions stands in contrast to more formal oversight over domestic rates, in accordance with the principles of rate of return regulation.

The situation in the United States is not wholly dissimilar from that in other countries. Government-owned PTTs are commonly alleged to make large profits on international services for the sake of subsidizing other services.

The situation in the United Kingdom is an interesting example of how international profits can be used to lower domestic rates. British Telecom (BT) was spun off from the British Post Office in 1981 and privatized in early 1984. In addition, the government decided to permit Mercury Communications to compete with BT for both domestic and international service, with this duopoly policy to be reviewed in 1990.

After BT's privatization, the British government assigned to the Office of Telecommunications (Oftel) the responsibility of applying price cap regulation, rather than rate of return regulation, in overseeing BT's prices and services. A price cap formula was established, given by the Retail Price Index (RPI) minus 3 percent annually. This cap permits BT to raise prices in line with general inflation, but it also forces BT to reduce real prices by 3 percent annually to reflect BT's greater expected productivity increases than those in the rest of the economy.

The cap has been applied to most of BT's local and national services, but not to international service. Oftel excluded international

[10]FCC (1975), pp. 1186–1187.

service for two explicit reasons. First, competition with Mercury is expected to help constrain BT's international prices. Second, forced reductions in BT's collection rates could cause a greater net outflow (or smaller net inflow) of calls that, combined with payments in accordance with high accounting rates, could have adverse effects. As the Director General of Oftel explains, "This feature of international telephony could cause sharp increases in outpayments following the application of normal price cap regulation and it could also have adverse effects on the UK's balance of payments."[11]

But there is another, perhaps more important, reason for not regulating BT's international rates. BT's excess profits on international service contribute to setting a new price cap formula that forces domestic rates to be lower than otherwise. The RPI-3 formula was formally reviewed in early 1988 and a revised formula was established to become effective in mid-1989 and to run for four years. The new formula was set at RPI-4.5—one that would put stronger pressure on BT to reduce domestic rates. BT's international profits contributed to this more stringent cap. As, the Director of Oftel noted, "I have taken the prospective profits from international telephony into account in proposing the level of the overall [revised] price-cap."[12]

EFFECTS ON ECONOMIC EFFICIENCY

Previous econometric studies generally show that the price elasticity of demand for international service is higher than is true for domestic long distance, whose price elasticity of demand is, in turn, greater than that for local service.[13] In terms of maximizing economic efficiency, i.e., maximizing the sum of consumer and producer surplus subject to the requirement that total cost be covered, the overpricing of international service goes in the wrong direction. "First-best" optimal pricing involves setting prices equal to marginal cost. But in decreasing cost industries (which is commonly assumed to include telecommunications), this pricing rule leads to revenues insufficient to cover total cost. In this situation, the lower the price elasticity of demand in a

[11]Office of Telecommunications (1988). No recognition is accorded in this statement to the possibility that competition with Mercury will also tend to reduce collection rates, possibly causing a no less "sharp" increase in outpayments.

[12]Office of Telecommunications (1988). In 1986, before-tax operating earnings as a percentage of revenues was 33 percent for British Telecom International, compared to 25 percent for BT's UK Communications that handles domestic service. British Telecom (1988), p. 36.

[13]Elasticity estimates for the various services are reported by Taylor (1980).

given market, the higher should price be raised above marginal cost to cover total cost. With international service more than covering its total cost, and given a relatively high international demand elasticity, the ratio of international prices to international marginal cost should be adjusted downward, relative to the ratio of domestic prices to domestic marginal cost, if social welfare is to be maximized.

But we must hasten to distinguish between domestic and global welfare. Whose surplus is at stake? The welfare effects of a reduction in U.S. international prices would partially flow to foreigners in two ways: (a) The increased volume of outgoing calls would increase consumer surplus in recipient countries, reflecting the benefits to those who receive, but do not pay for, the calls, and (b) at least some of the producer surplus otherwise enjoyed by U.S. carriers would be absorbed by foreign carriers through settlement payments to them for the additional volume of U.S. outgoing calls when the payments exceed the cost of foreign network use, as illustrated in Table 3.5. In contrast, for U.S. domestic service all such changes are internalized. Thus, in terms only of U.S. welfare, the optimal level of international prices would be higher, relative to domestic prices, than in the case of global welfare maximization.

An obvious possibility for coping with the conflict between national and global welfare maximization is for carriers on each side to negotiate agreements to simultaneously reduce prices similar in principle to free trade negotiations. Such negotiations are, in fact, a key element of the international telecommunications market as discussed in Sec. V.

Before turning to issues of negotiation, however, it is important to treat time-of-day pricing in the following section as another source of inefficiency in the use of telecommunications resources, in addition to problems posed by the excessively high overall level of international prices discussed here.

IV. TIME-OF-DAY PRICING

The preceding section focused on the overall *level* of collection rates and costs. Here we are concerned with the *structure* of rates with respect to time-of-day pricing, because adjustments in prices to reflect peak and off-peak demand can significantly affect the benefits to the United States and other countries from telecommunications services. Other dimensions of rate structure arise as well, such as the relationships among direct dial, station, and person rates. These lie outside the scope of this study. We concentrate here on direct dial rates, related to time-of-day use. Of particular concern are (a) the nature of optimal pricing, (b) the motivation of carriers to adopt, or not to adopt, prices that move toward optimality, and (c) impediments to improving price structures.

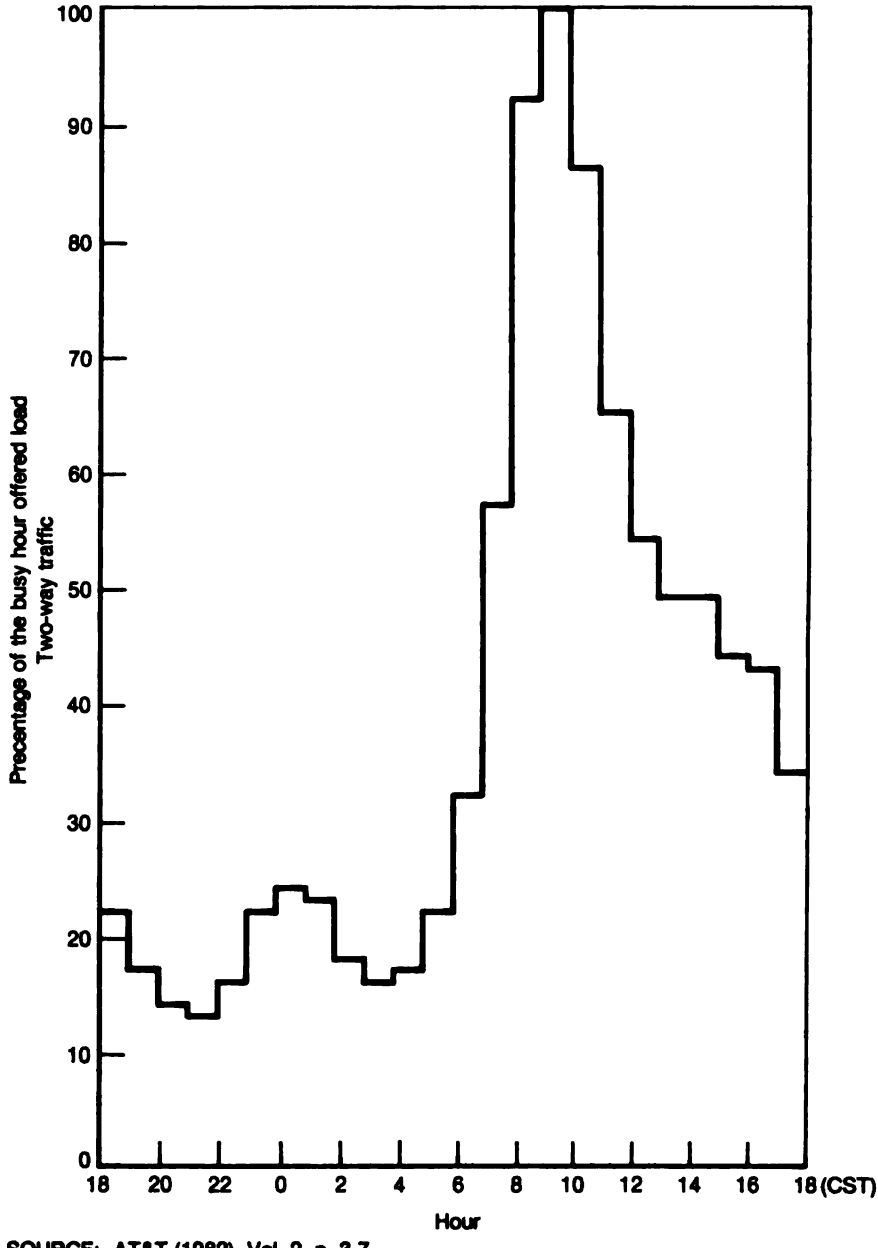
MARGINAL COST AND OPTIMAL PRICING

Almost all costs of supplying international service (as well as domestic service) are capacity costs. These are the costs embodied in the facilities required to handle a given peak volume of calls. This peak volume generally occurs during only a few hours of the day. This loading pattern is illustrated in Fig. 4.1 for traffic between the United States and Europe in 1981. The marginal cost of a call during periods of excess capacity is virtually zero. To maximize social welfare from telecommunications services (i.e., to maximize the sum of consumer and producer surplus), prices should reflect differences in marginal cost between peak and off-peak periods. Under simplifying assumptions, optimal prices involve a peak period price equal to the marginal cost of expanding capacity, with the off-peak price set at zero. Optimal capacity is one that handles the peak demand at these prices.[1]

Recognizing these large differences in marginal costs, U.S. and many foreign carriers have adopted time-of-day pricing. For international as well as domestic service, AT&T and its competitors have a three-period structure—standard, discount, and economy.

Before 1982 AT&T had a two-period rate to some countries and a single-period rate to others. In response to technological advances,

[1]See Boiteux (1949, 1960), Steiner (1957), and Park and Mitchell (1987). As noted in the preceding section, the need to satisfy an overall revenue requirement may require that prices exceed marginal cost.

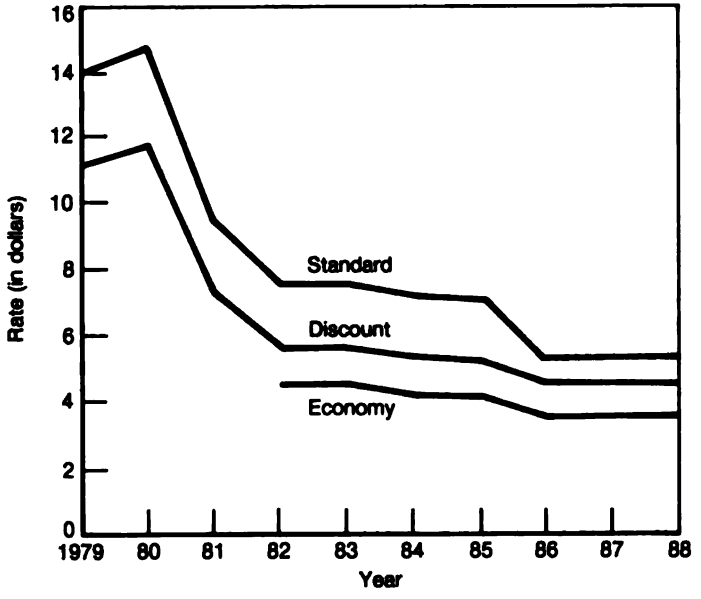


SOURCE: AT&T (1982), Vol. 2, p. 3-7.

Fig. 4.1—Twenty-four-hour traffic profile, United States and Europe

market growth, and strong urgings by the FCC, AT&T undertook a major restructuring in 1982 with large rate cuts and adoption of three-period collection rates to all countries.[2] The time path of AT&T's rate structure is shown in Fig. 4.2 for West Germany—a profile that applies to most other West European countries as well.

In contrast, many countries continue with only a single 24-hour rate for service to the United States. Of 99 countries with direct dial service to the United States in 1988, only 10 had a three-period structure, 31 had a two-period structure, and 58 had a single 24-hour rate.[3] Table 4.1 shows the situation in West European countries. In 1987, only the United Kingdom and France had a three-period structure and six others had only one. Movement toward a more differentiated time-of-day structure is shown from 1979 to 1987 for a few countries such as Switzerland, France, and Italy; but two others—West Germany and Netherlands—moved in the other direction.



SOURCE: Stanley (1988), p. 72, five-minute direct dial call.

Fig. 4.2—AT&T collection rate to West Germany, 1979–1988

[2]For a discussion of these factors, particularly the FCC's role, see AT&T (1982), Vol. 1.

[3]Stanley (1988), pp. 49–52.

Table 4.1

RATE STRUCTURES FOR TELEPHONE SERVICE TO THE UNITED STATES

	Number of Time Periods	
Country	1979	1987
United Kingdom	2	3
Sweden	2	2
Spain	2	2
Switzerland	1	2
West Germany	2	1
France	1[a]	3
Portugal	1	2
Belgium	1	1
Finland	1	2
Denmark	1	1
Greece	1	1
Italy	1	2
Iceland	2	2
Luxembourg	2	2
Netherlands	2	1
Norway	2	2
Austria	1	1

SOURCE: Eurodata (1979-1987).
[a]1980

This situation raises two questions:

- What motivations do carriers have to adopt, or not to adopt, time-of-day pricing, and why has AT&T moved more rapidly in this direction than many other countries?
- What impediments exist to improving time-of-day structures?

THE MOTIVATIONS OF CARRIERS

A PTT may be reluctant to move away from single-period pricing for two reasons: (a) the belief that reductions during off-peak periods would generate little new traffic (i.e., price elasticity of demand is low), resulting in a loss of net revenue, or (b) the belief that some peak load traffic would shift to off-peak resulting again in a loss of net revenue if

cost savings afforded by reductions in capacity requirements do not offset the reduction in gross revenues.[4]

Concern about loss of revenues is undoubtedly an important factor. For example, the views of the German Bundespost are expressed in correspondence with the author, who inquired of German officials about why the country moved from a two-period to a single-period rate in 1982 for calls to the United States. The reduction in rate periods, according to the reply,

> was carried out when the tariff for the peak period was reduced dramatically. The abolition of the off-peak tariff was not based on a theoretical background or a strategy. It was "pragmatic" in that sense: Why should we offer an off-peak tariff if the new peak tariff is even cheaper than the old off-peak tariff?[5]

In contrast, AT&T's adoption of time-of-day pricing may reflect its belief that the price elasticity of its off-peak traffic is greater than the elasticity that PTTs estimate for their off-peak traffic, and that a reduction in peak loads would be beneficial. In supporting its rate restructuring in 1982, illustrated in Fig. 4.2, AT&T observed that "whether or not callers shift from peak to off-peak periods, curtailment of usage from higher peak rates and stimulation of usage in response to off-peak rates may have some load-leveling effects."[6] Foreign PTTs may have greater doubts about these load-leveling effects.

Another factor is the cross elasticity of demand between outgoing and incoming traffic. A carrier would be more willing to adopt off-peak prices if it believed that additional outgoing traffic would stimulate the growth of incoming traffic. It will be more willing to reduce collection rates the greater is its estimated increase in the inflow of traffic caused by a given increase in outflow. This situation raises the question of whether outgoing calls are complements or substitutes for incoming calls. AT&T's adoption of off-peak prices may reflect its belief that off-peak outgoing traffic has a complementary relationship with incoming traffic, while many PTTs may believe that outgoing traffic has a substitution relationship with incoming traffic or has no relationship at all.

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[4]Dansby (1983) examines the conditions under which peak load prices will be adopted by bilateral monopolists, and shows the relevance of accounting rates and ratios of outbound to inbound traffic to establishing optimal price structures.

[5]Letter to author from Rudolph Pospischil, German Bundespost, 27 February 1989.

[6]AT&T (1982), Vol. 1, p. 3-2.

IMPEDIMENTS TO IMPROVING PRICING STRUCTURES

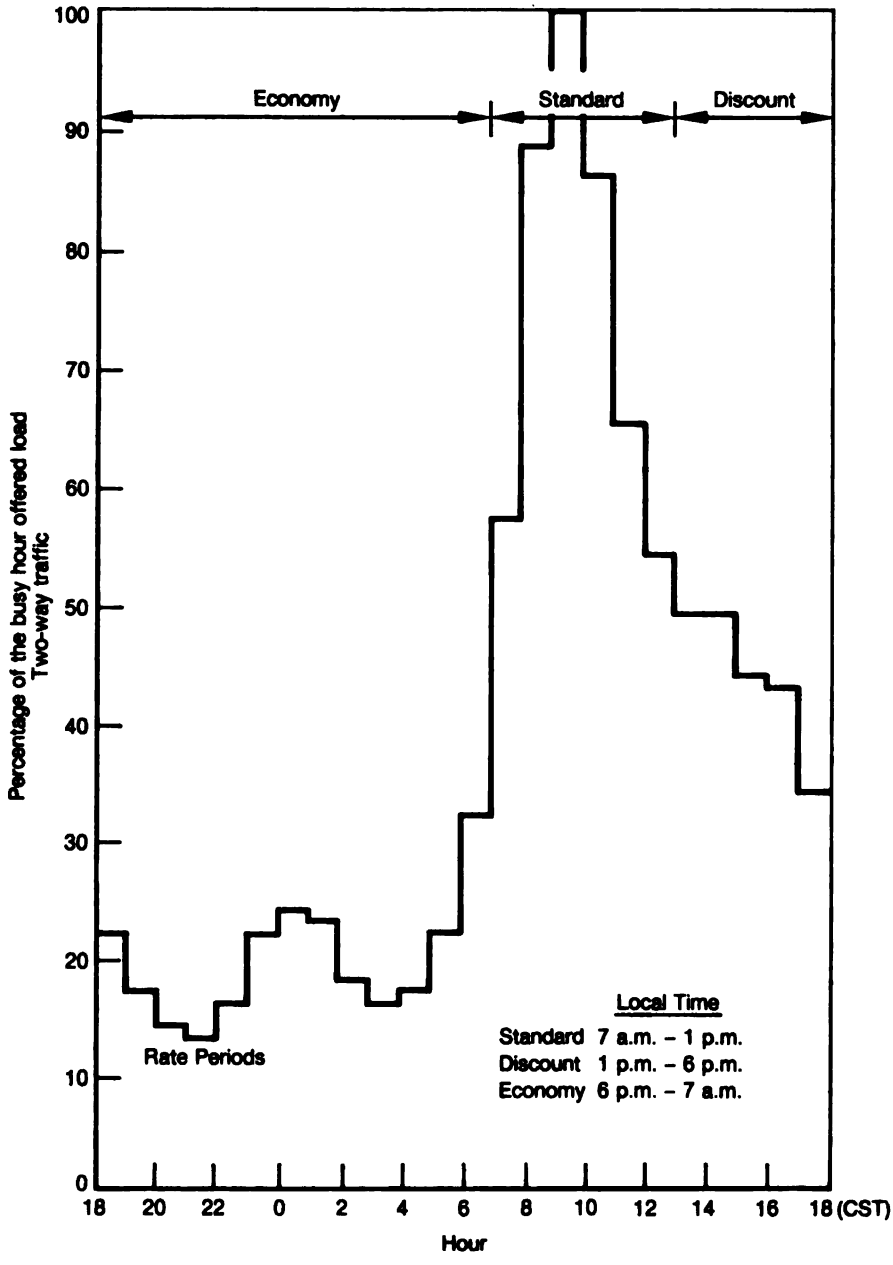
The three-period price structure adopted by AT&T in 1982 for Europe is illustrated in Fig. 4.3, where the three rate periods are superimposed on the traffic pattern from Fig. 4.1. Two aspects of Fig. 4.3 are striking. First, the peak period rate covers a six-hour period that extends well beyond peak hour traffic. Second, the economy rate period, and to a lesser degree the discount rate, cover time periods where traffic is far below peak levels and marginal cost is near zero. The economy rates to West European countries in 1988 of $1.16 for the first minute and $0.65 for each additional minute are well below the peak rates of $1.94 for the first minute and $1.09 for each additional minute. But they still are above the marginal cost of network use, at least when capacity is idle. Although a detailed assessment of current pricing structures in light of criteria for optimal pricing is far beyond the scope of this study, today's rate structures illustrated by Figs. 4.2 and 4.3 are probably far from optimal. Some calls are priced at peak rates when marginal costs are near zero; discounted and economy rates are also far above marginal cost.

Several reasons can be adduced as to why price structures generally vary from the optimal. Limitations on the number of rate periods that can feasibly be introduced, intraperiod variations in demand, and measurement costs immediately come to mind.[7] For our purposes it is useful to explore the impediments to optimal pricing that arise from the international characteristics, in contrast to the domestic characteristics, of telephone use. This study identifies the following four impediments.

Uniform Rate Periods in Local Time

To reduce customer confusion, and to facilitate national advertising of international services, AT&T sets international rate periods that are uniform in local time across the country. Thus, the peak rate period from 7:00 a.m. to 1:00 p.m. applies in local time across all four U.S.

[7]A more detailed discussion is contained in Park and Mitchell (1987). Their study, which deals with optimal pricing of local telephone service, concludes that under plausible assumptions a time-of-day rate is inferior to flat rate prices, that is, a fixed monthly fee with local calls priced at zero. This possibility arises because, with intraperiod variability in demand, some calls are inevitably charged high prices when marginal costs are zero, and others are charged low prices when marginal costs are high. If the cost of adding capacity is sufficiently low, which may be true for local networks, flat rate pricing would be superior to time-of-day pricing. The much higher costs of capacity for international service would render flat rate pricing economically inefficient today. But perhaps continuing technological advance will so greatly reduce per-circuit costs that flat rate pricing even for international service will eventually become economic.



SOURCE: AT&T (1982), Vol. 1, p. 3-26.

Fig. 4.3—Traffic profile and rate periods, United States and Europe

continental time zones. Figure 4.3 shows that peak use is from 9:00 a.m. to 10:00 a.m. Central Standard Time. This coincides with 7:00 a.m. to 8:00 a.m. Pacific Standard Time and with 10:00 a.m. to 11:00 a.m. Eastern Standard Time. Thus the peak rate period spans a number of hours to insure that it covers the period in local time during which the peak period of international calling occurs.

Uniformity in local time rate periods, though desirable in terms of customer acceptance, imposes efficiency losses. Particularly for calls placed near the end of the peak rate period, shown in Fig. 4.3, prices are far above marginal cost.[8]

Variations in Network Segment Usage

The traffic pattern in Fig. 4.3 depicts the combined load on satellite and underseas cable circuits for calls to and from Europe.[9] However, this load pattern does not fully coincide with the load patterns for either the U.S. or European national networks required for end-to-end service. When international cable and satellite facilities are lightly loaded during the early morning hours in the United States, these same hours may correspond to heavy use of European national networks. Thus, a call to West Germany placed at 4:00 a.m. Central Standard Time could occur during the peak period use of West Germany's domestic network. If so, the marginal cost of the call would not be zero, as suggested in Fig. 4.3, but would reflect the capacity cost on the German domestic network imposed by the call. Calls to other European countries, priced at the same rate as to Germany, would involve varying marginal costs. Thus, differences in marginal costs across countries, combined with rate uniformity to these countries from the United States, cause additional efficiency losses in international network use.

Although differential loading patterns for network segments should be noted, their importance is limited. Even during times when a domestic segment of the international network is heavily loaded,

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[8]This problem occurs, in less severe form, for calls across time zones within the United States, since domestic rate periods are also uniform in local time. Thus, a call from the West Coast, at 6:30 a.m. when the economy rate applies would reach the East Coast during the heavy traffic period at 9:30 a.m.

[9]The traffic profile for calls to and from the United Kingdom and Ireland, not shown in this study, is similar to that in Fig. 4.3. Traffic patterns with other parts of the world vary greatly from that in Fig. 4.3, with some having bimodal distributions. The rate periods in local times for these regions also vary from those shown in Fig. 4.3. This study focuses on U.S.-European traffic for illustrative purposes.

arising from time zone differences, the marginal cost of that portion is probably small relative to the price of the international call.[10]

Uncoordinated Rate Structures Among Countries

The ability of a country to modify traffic loads with time-of-day pricing depends on the actions of its partners. AT&T's three-period structure would enhance the efficiency in using international cable and satellite facilities if other countries had a structure covering the *same* time periods of peak and off-peak facilities use. If the other country has only a single 24-hour rate (such as West Germany), AT&T's ability to modify traffic loads is more limited. Even if other countries have multiperiod rates, the time periods may not coincide with AT&T's time periods. For example, the French economy rate runs from 2:00 a.m. to 10:00 a.m. French time, which translates to 7:00 p.m. to 3:00 a.m. Central Standard Time. This is a shorter time period than AT&T's 6:00 p.m. to 7:00 a.m. rate. Italy has a single discount rate that runs the equivalent of 4:00 p.m. to 1:00 a.m. Central Standard Time. This is a much shorter period than AT&T's combined economy and discount periods that run from 1:00 p.m. to 7:00 a.m.[11]

High and Inflexible Accounting Rates

High accounting rates are a major impediment to lowering the (off-peak) economy collection rate. In some cases AT&T and its competitors pay more to PTTs to complete the calls than they collect from customers. U.S. carriers literally lose money on every economy rate call to some countries. Table 4.2 shows AT&T's situation for seven of the 10 countries that have the largest traffic flows with the United States (from Table 2.3) for which adequate accounting rate data are available. Only with Japan and Taiwan does AT&T collect more than it pays.

Why does AT&T set collection rates below settlement payments to PTTs? Three possibilities are worth noting:

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[10]The price of a U.S. coast-to-coast direct dial call is less than 30 cents per minute during the peak period. Presumably, this price covers the high marginal cost of peak period use. AT&T's direct dial *economy* rate to West Germany (and to most of Western Europe) is $1.16 for the first minute and $0.65 for each additional minute—more than twice as great as the *peak* rate for domestic service.

[11]Examination of criteria by which carriers choose the length of time periods and the degree to which they seek to coordinate their actions lies beyond the scope of this study. But it is certainly one of the many areas that deserve further analysis.

Table 4.2

AT&T REVENUES AND PAYMENTS TO PTTS, DIRECT DIAL ECONOMY RATE, FIVE-MINUTE CALL, 1988

Country	AT&T Revenue	Payment to PTT
West Germany	$3.76	$4.62
Japan	$5.41	$4.42
France	$3.76	$4.69
Italy	$3.76	$5.39
Colombia	$4.24	$4.75
S. Korea	$5.14	$6.30
Taiwan	$5.94	$5.00

SOURCE: Stanley (1988), Appendix H.

- AT&T may believe that the growth of outgoing economy rate calls stimulates the growth of incoming traffic (a complementary relationship) so that, on balance, AT&T comes out ahead.
- Given the rate of return constraint, which was binding before the divestiture, AT&T may have needed to reduce prices somewhere. Reducing and restructuring international rates may have been preferable to other price changes, in terms of maximizing overall profits, given that the firm must reduce earnings to stay within its authorized rate of return.
- The situation may reflect the outcome of the bargaining process, which involves both collection rates and accounting rates, between AT&T and foreign carriers. The steep decline in collection rates, shown in Fig. 4.2, and adoption of the economy rate may have been offered in exchange for lower accounting rates for all calls. The additional incoming traffic to the PTTs stimulated by lower U.S. collection rates may have contributed to their agreeing to lower accounting rates. The losses on AT&T's economy-rate traffic shown in Table 4.2 might be more than offset by the gains from the lower accounting rates applied against all of its traffic.

The preceding explanations all hinge on factors that offset the losses from high accounting rates in particular markets. But one must expect a limit to the value of such offsets. Although AT&T may be willing to take the losses illustrated in Table 4.2, presumably it would not be willing to cut its economy rates by, say, 50 percent and take even

larger losses. Yet, optimal rates might be far less than 50 percent of existing ones.

The difficulty lies in the floor set by accounting rates. Today, most accounting rates do not vary by time of day and they are split 50/50 for purposes of settlements among carriers. Ideally, accounting rates would reflect the cost incurred by a carrier for use of its network in originating or terminating calls. This cost varies by time of day, and is surely not identical for the two carriers that are parties to any given accounting rate.

As an outcome of continued bargaining among carriers, time-of-day accounting rates have recently been established by AT&T with the United Kingdom and a few other countries. In a few other cases—Brazil being the most notable—agreements have recently been reached in which the accounting rate is held constant for the traffic volume recorded at a particular date, and a lower rate is applied to future traffic volumes above that level.

Although accounting rates have fallen, as illustrated in Tables 2.5 and 2.6, they still seem far from reflecting the marginal cost of network use.[12] To be sure, to cover total cost, prices must exceed marginal cost in declining cost industries, as noted previously. But, as shown in Sec. III, AT&T and foreign carriers already are earning revenues well above total cost. This situation suggests that overall rates should be reduced, especially during off-peak periods, both because off-peak prices greatly exceed marginal cost and because they appeal especially to residential users whose price elasticity of demand is probably higher than that of business users.

SUMMARY

Adoption of peak load prices is a slow process with many PTTs resisting movement away from a single-period rate. Their behavior is probably explainable by the adverse effects they estimate that time-of-day pricing would have on their revenues.

Although determination of the optimal set of time-of-day prices is far beyond the scope of this study, there is reason to conclude that economy rates, at least, are too high for traffic to Western Europe. Several impediments exist to improving rate structures: (a) uniform rate periods in local time, (b) variations in network segment usage, (c)

[12]The importance of reducing and restructuring accounting rates is emphasized in more detail by Dansby and Luciano (1987). They show under simplifying assumptions the conditions under which negotiations between bilateral monopolists would lead to mutually beneficial, and socially beneficial, adjustments in accounting rates.

uncoordinated rate structures among countries, and (d) the existence of high and inflexible accounting rates. AT&T and other U.S. carriers are willing to set economy rates below the payments made to some PTTs because of offsetting gains elsewhere. But one must expect a limit beyond which the U.S. carriers are not willing to go without a reduction and adjustment in accounting rates.

Although accounting rates have generally declined, and time-of-day rates have been adopted by a few countries, accounting rates generally remain far above marginal cost, at least during off-peak periods. Ideally, accounting rates should reflect the marginal cost of using a carriers' network, where cost varies by time of day.

The next section discusses how growing competitive market pressures will help move the industry toward more efficient collection and accounting rates.

V. COMPETITION AND THE ROLE OF GOVERNMENT REGULATION

The preceding sections dealt primarily with AT&T as the dominant provider of international voice service. Within that context, we have examined the differences between overall revenues and costs, price structures as they relate to time-of-day traffic, and the implications for economic efficiency.

Here, we focus on the growth of competition as it relates to five topics: (a) how U.S. carriers gain access to foreign markets, (b) how monopoly PTTs might "whipsaw" competing U.S. carriers by playing one against another to capture for themselves much of the gain from competition, and the tools that the FCC uses to protect U.S. carriers against whipsawing, (c) whether the net dollar outflow for telephone service is related to the bargaining power of the PTTs, (d) what limitations exist to the bargaining power of the PTTs, and (e) what the implications of the above are for FCC regulatory policy.

COMPETITIVE ACCESS BY U.S. CARRIERS TO FOREIGN MARKETS

AT&T's competitors, such as US Sprint and MCI, have two incentives to participate in the international market. First, they are attracted by the potentially large profits, suggested by the disparities between revenues and costs calculated in Sec. III. Second, to provide "full" service to their (primarily) domestic subscribers, they must offer international dial access comparable to that provided by AT&T. A competitor seeking to be the primary carrier of a residential or business subscriber would be handicapped if customers had to go through special procedures for international calls. Even if a particular customer expects to make few if any international calls, the customer may value the *option* of making such calls highly enough to warrant careful attention by the carrier in its marketing strategy.

There are three ways that carriers can gain access to a foreign country: (a) by procuring and reselling AT&T's circuits, (b) by using a transit route through a country with which the carrier has an operating agreement, and (c) by establishing an operating agreement directly with the country in question.

Reselling Use of AT&T's Circuits

Here the carrier pays for circuit use at AT&T's "wholesale" bulk discount rates (for example, under its Megacom WATS tariff) and offers them to its customers at a price equal to or below AT&T's "public" tariffs for overseas calls. The carrier's net revenue depends on the spread between AT&T's retail and bulk discount rates. After adding its expenses of handling the service, the carrier is unlikely to find this to be a highly lucrative market. The primary reason for reselling AT&T's circuits is to assure its own customers of universality of service. Presumably, the carrier would willingly take a loss on overseas service, if international coverage stimulated the growth of its U.S. domestic service revenues to more than compensate.

Reselling limits the spread between AT&T's wholesale and retail rates. But the reseller, dependent on AT&T circuits, is constrained in offering new and innovative services or in cutting prices well below those of AT&T. Reselling promotes competition insofar as it eliminates the handicap that the carrier would otherwise face in competing with AT&T for primarily domestic business.

Transit Arrangements

A second possibility is to serve the country in question via a third country with which the carrier has an operating agreement. To illustrate, suppose that the U.S. carrier X has an operating agreement with country B but not with country C, but country B has an operating agreement with country C. AT&T also has an agreement directly with country C with which the accounting rate is $2.00. Suppose that country C is reluctant to deal directly with carrier X because it would generate only small amounts of traffic to C for which additional administrative and other expenses would be incurred. It is more economic to handle traffic from X by way of country B, which already has a substantial traffic flow to C.

Assume that country B charges carrier X a transit fee of $0.25. For each originating call minute, carrier X would pay a transit fee of $0.25 to country B, and $1.00 (the same rate that AT&T would pay) to country C. Carrier X's net revenue would be equal to its collection rate minus $1.25.

As noted above, cases arise in which 50 percent of the accounting rate exceeds AT&T's collection rate, especially for economy service. Since carrier X could charge no more than AT&T, and would pay a transit fee as well, carrier X would suffer even greater losses in handling this traffic. More generally, it would lose whenever 50 percent of

the accounting rate plus the transit fee exceeds the collection rate. In these cases it would probably choose to serve country C by reselling AT&T circuits rather than using a transit arrangement.

Again, opportunities for competition between X and AT&T are limited because X must pay a transit fee while AT&T does not, and X may not be able to negotiate any lucrative return traffic from country C, as part of a transit arrangement. Moreover, the quality of X's service to country C may be lower than AT&T's because of circuitous routing through country B. For example, the call might go on a transatlantic cable to country B, located in Europe, and from country B to country C (located in Africa or South America) by satellite. In contrast, AT&T might route traffic directly by satellite to country C.

Use of Operating Agreements

Carrier X would need an operating agreement with country C to participate fully in the international market. Most importantly, the operating agreement would generally assure carrier X of some portion of lucrative return traffic, as well as reduce transit fees and indirect routings.[1]

But obtaining an operating agreement can be difficult for several reasons. First, the PTT must be persuaded that carrier X will generate enough traffic from the United States to offset the additional administrative and operating expense of dealing with an additional U.S. carrier. The success of MCI and US Sprint in obtaining agreements is due in part to their having a growing domestic market share.

Second, the PTT would be concerned with the quality of service offered by the U.S. carrier for return traffic. Generally the "proportionality" principle is used to determine the volume of return traffic. Carrier X receives the same percentage of return traffic that it originates from the United States. Thus, calls originated by the PTT are, in effect, assigned arbitrarily to competing U.S. carriers. But suppose carrier X gives poor service, perhaps because it has only a few circuits to that country or because of inadequacies in its own domestic network. The PTT's customers who receive this poor service are likely to blame the PTT. Thus, the PTT must exercise caution in entering into return-traffic agreements.

Third, overall efficiency of circuit use tends to decline as the number of U.S. carriers increases. A bundle of, say, 60 circuits in the hands of one U.S. carrier can handle more traffic at a given blockage rate (the

[1]Even if the carrier has an operating agreement, transit routings may be required for access to some countries.

percentage of calls that are not completed), than can 60 circuits divided equally between two carriers. As the number of U.S. carriers expands, the total number of circuits required to handle a given total level of traffic at a given blockage rate rises, imposing additional costs on the PTT and U.S. carriers. This problem becomes less severe as total traffic volume increases. Thus, countries with large traffic volumes with the United States are the most likely to be willing to enter into multiple operating agreements.

On the other side, an obvious incentive exists for the PTT to enter into multiple agreements. Competition among U.S. carriers puts downward pressures on their collection rates, simulating the growth of traffic terminated by the PTT and, hence, the growth of its settlements revenues. These revenues are all the larger if the accounting rate is high. Table 5.1 shows the reductions below AT&T's collection rates that MCI and US Sprint offered to the United Kingdom and to France in 1987.

With an operating agreement in hand, and with its own international facilities, carrier X is less dependent on the difference between AT&T's retail and bulk discount tariffs or on the willingness of other countries to enter into transit agreements. It is freer to set its rates below those of AT&T, while being able to reap whatever benefits accrue from handling return traffic.

MCI and US Sprint have succeeded in negotiating operating agreements with a number of countries. By May 1988 MCI had direct operating agreements with 32 countries and transit arrangements with 38 others, and US Sprint had operating agreements with 26 countries and transit agreements with 52 others.[2]

Table 5.1

U.S. CARRIER TARIFFS, FIVE-MINUTE DIRECT DIAL, 1987
(In dollars)

	To United Kingdom			To France		
	AT&T	MCI	US Sprint	AT&T	MCI	US Sprint
Standard	5.78	5.48	4.88	6.49	6.14	5.83
Discount	4.36	4.31	3.82	4.88	4.83	4.38
Economy	3.49	3.44	3.39	3.87	3.82	3.71

SOURCE: FCC (1988a).

[2]As reported by AT&T (1988) p. 13.

THE PHENOMENON OF WHIPSAWING

The FCC and others have long been concerned about the superior bargaining power that monopoly PTTs might exercise against competing U.S. carriers. Facing competitive carriers, the monopolist might attempt to play one off against the others for its own benefit. This concern arose originally with respect to record carriers which, unlike AT&T, have faced competition for decades.

Consider the following example of whipsawing in the telex market where, as noted in Sec. II, the volume of incoming traffic exceeds outbound traffic. Suppose that the PTT of country C has an operating agreement with U.S. carrier Y. An additional U.S. carrier X, seeking an operating agreement with the PTT, is told that it must accept a lower accounting than the existing one with Y. Since U.S. telex carriers receive more traffic than they originate, the lower accounting rate would benefit the PTT at the expense of X. Despite the disadvantage of the lower accounting rate, X decides that it is better off serving country C under this agreement than to be shut out entirely. The PTT then uses the agreement with X to extract a lower accounting rate also from Y by threatening to reduce the level of return traffic to Y. This is a credible threat by the PTT because it would benefit from shifting traffic from Y to X at the lower accounting rate. Thus, profits of the U.S. carriers are lower than before the entry of X, but the PTT enjoys increased revenues. The United States may be worse off because the sum of U.S. consumer and producer surplus resulting the entry of X may be lower than when Y was free to bargain as a monopolist on the U.S. side against the monopoly PTT.[3]

The Uniform Settlements Policy

Seeking to prevent such outcomes, the FCC has pursued a "uniform settlements policy" developed during the 1930s. This policy requires that operating agreements stipulate (a) uniform accounting rates on parallel routes to the country in question, (b) uniform terms for the sharing of tolls under the accounting rate (generally 50/50), and (c) uniform settlements rates (usually U.S. dollars, gold francs, or special drawing rights). In the above example, carrier X would not be free to

[3]The outcome of bargaining between bilateral monopolists compared with outcomes where one side consists of competitive firms is discussed in detail by Kwerel (1987). He shows, under simplifying assumptions, that no benefits accrue to the United States from competition among U.S. carriers when access to the foreign market is held by a monopolist. Specific cases of alleged whipsawing in the record market are discussed by O'Brien (1988), who models the bargaining process between the PTT and competing U.S. carriers.

accept the lower accounting rate against the objections of Y on grounds of nonuniformity. Any change in accounting rates must have the concurrence of other parties, all of which become parties to the new uniform rate. In this way, U.S. carriers presumably have the same bargaining power as would a single firm facing the monopoly PTT.

In recent years questions have arisen about whether the uniform settlements policy should be applied to voice (where AT&T had previously held a monopoly) and whether the policy is an effective device against whipsawing.[4] Some argue that whipsawing is unlikely in the voice market, in contrast to the record market, because the volume of U.S. outbound voice traffic exceeds the volume of inbound traffic.[5] If the PTT of country C seeks to extract a high accounting rate from the newcomer X, the PTT would be obliged to pay *more* to X for return traffic to the United States than it paid to Y under the lower accounting rate. The threat by the PTT to shift its return traffic from Y to X would not be credible because the PTT would pay more, rather than less, to X because of the higher accounting rate negotiated with X.[6]

However, other ways exist to use accounting rates to whipsaw U.S. voice carriers. Suppose, again, that U.S. carrier X seeks an operating agreement with the PTT of country C, already served by carrier Y. Carrier X is able to obtain agreement to terminate a portion of the PTT's traffic at the accounting rate existing with Y, but only on the condition that X's outbound service to the PTT be settled at 60 percent rather than 50 percent of the accounting rate (thereby increasing the PTT's revenues on its inbound service). Carrier X agrees to the deal because the return traffic from the PTT is sufficiently lucrative to more than offset the financial squeeze on X's outbound traffic, which is compensated by the PTT at only 40 percent of the accounting rate. With the agreement in hand, the PTT threatens to funnel even larger portions of its outbound traffic through X instead of Y, unless Y *also* accepts the modified split in the accounting rate. With the acceptance by Y of the new terms, the PTT gains at the expense of both X and Y.[7]

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[4]O'Brien (1989) concludes that, under plausible assumptions, the uniform settlements policy can raise accounting rates above those in the absence of the policy.

[5]AT&T, Comments (1985) p. 23.

[6]The asymmetry between the telex and telephone cases, where whipsawing works in one but not in the other, can be explained as follows. The PTT has control over the distribution of its originating traffic to X and Y, but not over the originating market shares of X and Y. This control works to the advantage of the PTT if it seeks to lower accounting rates (the telex case), but not if it seeks to raise accounting rates (the telephone case).

[7]This particular example is drawn from MCII (1985), p. 6.

The International Settlements Policy

In early 1987, the FCC decided not to apply a strictly uniform settlements policy in the voice market, on grounds that nonuniformity "is not necessarily indicative of whipsawing or otherwise harmful."[8] Under the FCC's new "international settlements policy" any voice carrier seeking to establish a nonuniform accounting rate must, 21 days in advance, notify the commission and all other carriers serving the country in question. Other carriers have 10 days to protest, in which case the commission makes a determination. To this writing, protests have been filed against a few proposed waivers, but the commission has determined in all cases to permit the new accounting rate to go into effect.

Under the FCC's international settlements policy the preceding outcome would not have occurred because Y would have objected to the PTT's proposed modified split deviating from 50/50 and the commission would probably have not allowed it to go into effect on grounds of potential whipsawing.

But even if the new split had not been permitted, the PTT of country C may have other tools to extract concessions from X and Y. Consider an example where whipsawing can occur by use of return traffic agreements rather than accounting rate as a bargaining tool: The PTT is willing to sign a return traffic agreement favorable to country X only on condition that X use country C as a transit point for traffic to specified other countries. This agreement may benefit country C because of additional transit fees at the expense of X who might have preferred a less costly transit arrangement through another country. The PTT then attempts to extract similar concessions from Y by threatening to shift return traffic to X.

The relationship between outbound and inbound traffic is generally governed by the proportionality rule as noted in Sec. II. But variations in how the proportionality rule is interpreted and implemented cause variations in the relationship between U.S. outbound and inbound traffic. Thus, agreements about return traffic also constitute an important bargaining tool.

Moreover, as the FCC recognizes, nonuniform accounting rates do not necessarily lead to whipsawing. To obtain an operating agreement with the PTT, carrier X may be willing to negotiate a less favorable rate to itself than the rate that exists between Y and the PTT. As long as the PTT does not seek to use the agreement with X to extract concessions from Y, whipsawing would not occur. In addition, the United States may be better off with the nonuniform rate because the

[8]FCC (1987), p. 5.

gain in consumer surplus caused by the entry of X could more than offset the loss of producer surplus to the PTT. Indeed, if the goal is to adopt accounting rates that reflect costs of network usage as noted in Sec. IV, where these costs vary among countries, nonuniform accounting rates with modifications from the 50/50 split would be appropriate.

Gains to PTTs Without Whipsawing

Even if the PTT does not explicitly play off one U.S. carrier against another, it is in a strong position to extract concessions from competing U.S. carriers. As just one possibility, to compensate the PTT for the burden of dealing with an additional carrier, X offers to cover the cost of modifying the PTT's software, switching, and such. The PTT agrees but only under terms of compensation that far exceed the additional costs. Even after the agreement is signed, the PTT might threaten to terminate it to gain continuing concessions from X.

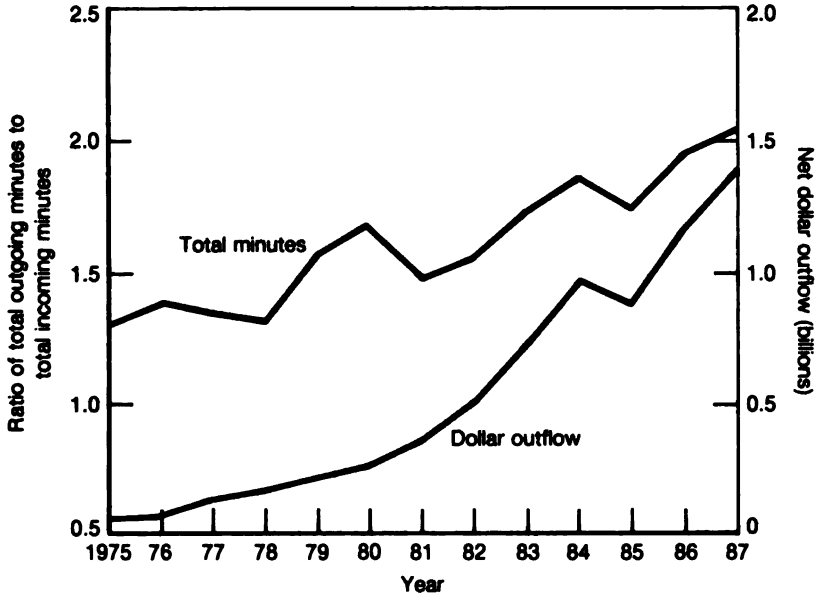
More generally, the PTT may allow entry to additional U.S. carriers and then reap the benefit of the additional incoming traffic stimulated by their competitive reductions in collection rates. By maintaining high accounting rates in the face of falling costs, the PTT, in effect, imposes progressively higher "taxes" on the U.S. carriers for access to its network. Reductions in collection rates benefit U.S. consumers, but the PTT gains producer surplus at the expense of U.S. carriers.

In response to reductions in U.S. collection rates, the PTT may be willing to reduce its accounting rates—but only by a smaller percentage. Tables 2.5 and 2.6 illustrate the relatively slow decline in accounting rates for selected countries.[9]

THE NET DOLLAR OUTFLOW

As illustrated in Fig. 5.1, the ratio of originating to terminating minutes grew from about 1.3 to 1 in 1975 to more than 2.0 to 1 in 1987. The net payments outflow (excluding Mexico and Canada) grew from about $69 million in 1975 to nearly $1.4 billion in 1987. Countries with which the deficit was the largest in 1987 are shown in Table 5.2.

[9]Much of this decline occurred when AT&T held a monopoly of telephone service. Sufficient time series data are not yet available to determine whether declines in collection rates, relative to accounting rates, are even greater with competition among U.S. carriers. Typically, several years elapse before accounting rates with a given country are changed. Because competition on the U.S. side was not a significant factor before about 1985, it is not yet possible to determine whether competition is having a significant effect on the relationship between collection and accounting rates.



SOURCES: FCC (1988d), p. 13; *Distribution of IMTS Minutes* (undated).

Fig. 5.1—Traffic and dollar flows

In 1987, the United States ran surpluses with 11 countries, most notably Canada at $19 million, Lebanon at $3 million, Sweden at $2 million, and Panama at $1 million.[10]

However, the data in Fig. 5.1 by themselves do not constitute evidence that the PTTs are in a superior bargaining position relative to the United States. If, at prevailing prices, U.S. residents prefer to use telephones for communications, while foreign residents prefer to use the mails, or telex, or prefer to receive calls but not to make them, this situation would reflect no more than the common phenomenon where a country imports more of a particular good or service than it exports. The completion of a call from the United States can be regarded as the "importation" by the United States of a service from abroad—the use of the PTT network. The fact that we import more of these services than do foreigners is not by itself an indication of relative bargaining strength.

[10]FCC (1988d), p. 21.

Table 5.2

U.S. BALANCE OF PAYMENTS DEFICIT FOR INTERNATIONAL TELEPHONE SERVICE, 1987

Country	Deficit (Millions)
Mexico	$313
West Germany	$126
Philippines	$86
Korea	$85
Japan	$78
Colombia	$58
United Kingdom	$57
Italy	$51
Dominican Republic	$48
Israel	$44
Taiwan	$40

SOURCE: FCC (1988e), p. 20

To be sure, the stronger bargaining power of a monopoly PTT facing competitive U.S. carriers would be expected to show up in an increasing dollar outflow as the U.S. side becomes increasingly competitive. By refusing to reduce accounting rates quickly, and enjoying the benefits of competitive price cutting by U.S. carriers, the PTT would extract increased earnings. These earnings would be reflected in the increased net dollar flow to the PTT arising from the expansion in U.S.-originated traffic caused by reduced U.S. collection rates and relatively high accounting rates. The increase in dollar outflow shown for 1985–1987 may reflect the competitive squeeze on U.S. carriers.

But more is involved. Figure 5.1 also shows that large increases in net dollar outflow occurred before 1985, while AT&T was the monopoly telephone carrier. Bargaining on a bilateral basis with PTT monopolists, it was not vulnerable to whipsawing along the lines discussed above. The fact that the bargaining process led to a net outflow of dollars does not necessarily mean that the PTTs had a stronger bargaining position than did AT&T. It is quite conceivable that each carrier, seeking to maximize its own profits, would end up with a nonzero net dollar flow—either inward or outward. For example, AT&T might have agreed to relatively high accounting rates because, in return, it was able to (a) obtain more favorable operating agreements than otherwise, or (b) obtain more favorable transit agreements for itself than otherwise, (c) persuade the PTTs to reduce their collection rates by

greater amounts than otherwise. Such agreements could result in an increased net dollar outflow at the same time that they increase AT&T's profits by expanding the *total* flow of outbound and inbound traffic.

Two qualifications, however, are relevant to considering AT&T's bargaining power. First, because AT&T was under a binding rate of return constraint before the divestiture, as discussed above, it may have set lower collection rates than it would if it had been free to maximize profits. If so, the level of outbound traffic would have been greater with the binding rate of return constraint (depending on the elasticity of demand). Second, a binding rate of return constraint reduces the firm's incentives to minimize cost for a given output, because it can pass increased costs on to consumers by raising its rates (albeit with time delays associated with regulatory processes). Facing this situation before divestiture, AT&T may have been more willing to accept higher accounting rates, which would add to its costs, than it would in the absence of rate of return regulation. In short, AT&T's bargaining situation may have been compromised relative to PTTs not subject to rate of return regulation.

The situation has markedly changed since 1984. The international market has been opened to competition and, as a consequence, AT&T's rate of return constraint is not binding today. Consequently, one would expect it to be much more concerned with high accounting rates than in earlier years. Indeed, in recent presentations it has stressed the importance of lowering accounting rates and has highlighted its success in renegotiating more favorable agreements in recent years. During the first 18 months after divestiture it succeeded in renegotiating 89 agreements for lower accounting rates, compared to 51 agreements during the previous two years.[11]

LIMITATIONS ON THE BARGAINING POWER OF PTTS

Although the growth of U.S. competition enhances the bargaining power of PTTs, the shift in bargaining power is not without limit because of three related factors: (a) Possibilities exist of both end users and carriers routing traffic through third countries, which may force PTTs (though themselves monopolies) to compete for U.S. traffic; (b) PTTs may be forced to liberalize their entry policies because of competitive pressures in the global market place induced by

[11]AT&T (1985), attachment A. AT&T estimates that reductions in accounting rates from these 140 agreements caused a net increase in AT&T's retained revenue (or a reduction in the net dollar outflow) of $470 million through 1986.

telecommunications liberalization in other countries; and (c) attempts by numerous competitors to gain entry into a country may directly erode the PTT's monopoly bottleneck. As discussed below, these factors have important implications for U.S. regulatory policy.

Third-Country Routings

Differences in Collection Rates. Suppose that the collection rate from country A to country B, plus the rate from country B to country C is lower than the rate from country A to country C. (The reader will immediately recognize the analogy to a situation common in the airline industry.) Table 5.3 illustrates this phenomenon for direct traffic from West Germany to the United States, and for West German traffic routed through the United Kingdom. A direct call (in local currency converted to dollars) is more expensive than the call routed through the United Kingdom. Thus, a multinational firm can route its calls from West Germany to the United States through its PBX in the United Kingdom. As described in one study, such practices are common.

> Attractive rates between the U.K. and the U.S. have made it cheaper for multinational companies to route their calls through London than directly from Europe to the United States. As a result, almost one-third of the multinationals in Europe route their telecommunications traffic through the U.K. Because of this traffic pattern, calls between the U.S. and the U.K. now account for almost half of the $700 million transatlantic telephone market.[12]

Because these practices divert revenues from West Germany to the United Kingdom for traffic destined to the United States, why does not West Germany simply raise its collection rates to the United Kingdom to eliminate the disparity? The answer is that doing so would reduce its traffic flow destined only for the United Kingdom, possibly causing even a greater loss of revenue. Because there is no way to distinguish between direct and third-country traffic flowing to the United Kingdom, it is impossible to set discriminatory rates between the two traffic flows.

Moreover, were West Germany to increase its collection rates to the United Kingdom, the multinational firm might route its traffic through yet other European countries with attractive rates to the United Kingdom. Knowing this, countries would be expected to compete in handling this traffic.

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[12]Bruce et al. (1986), p. 456.

Table 5.3

TELEPHONE RATES: DIRECT AND INDIRECT ROUTING
FIVE-MINUTE DIRECT DIAL, 1987
(In dollars)

Time Period	West Germany to United States ($)	West Germany to United States via United Kingdom ($)
Peak	10.09	8.86
Standard	10.09	8.42
Economy	10.09	6.87

SOURCE: Eurodata Foundation (1987).

Highly relevant here is the emergence of bilateral competition between U.S. and U.K. carriers. Competition between Mercury Communications and BT will tend to reduce collection rates to the United States in the same way that competition among U.S. carriers encourages rate reductions in the other direction. These rate reductions will make the United Kingdom a progressively more attractive transit point for European traffic. To avoid a diversion of revenues to the United Kingdom, other European countries will be under pressure to reduce their rates for direct traffic to the United States.

Differences in Accounting Rates. Similar to the preceding, the sum of the accounting rates between countries A and B and between countries B and C may be smaller than the accounting rate directly between countries A and C. If so, the carrier in country A could use transit routing through country B to reach country C, thereby reducing its overall settlement payments. Unfortunately, we cannot make comparisons similar to those for collection rates involving the United States, the United Kingdom and West Germany because PTTs hold accounting rate data as proprietary. Only in the case of accounting rates involving the United States are figures released to the public. This exception arises because of the need for disclosure to the FCC for its oversight over the establishment of accounting rates as described above.

Lacking comparative accounting rate data, the author has relied on interviews with knowledgeable industry officials. According to these interviews, competition does exist among PTTs—at least in Western Europe—for transit traffic involving the United States. Country C's bargaining power with U.S. carriers (country A) is reduced by the possibility of moving traffic through third countries such as country B. In

response to this threat, country C might seek to increase the accounting rate with country B. But suppose that country C originates more traffic to country B than it receives from it. Increasing the accounting rate with country B to discourage transit traffic with the United States would cause country C to make larger net payments to country B than before. Thus, country C's ability to maintain high accounting rates with the United States is constrained by possibilities of moving traffic through third countries.

Continuing technological advance will also contribute to competition among PTTs for U.S. traffic. The United States and other countries are moving rapidly with installation of terrestrial and underseas fiber optic networks. The TAT-8 cable, completed across the North Atlantic in December 1988, by itself has enough capacity to handle all North Atlantic traffic forecast for 1990.

Seeking to promote competition among facilities providers, the FCC has authorized the development of intercontinental satellite systems "separate" from the global INTELSAT system, and it has granted landing licenses to "private" transoceanic fiber optic cables (i.e., those not owned by the traditional monopoly carriers) in addition to existing and planned cable facilities (such as TAT-8) jointly owned by U.S. carriers and foreign PTTs. Pan American Satellite launched its first satellite in 1988 and has agreements with the United Kingdom, Germany, Peru, Chile, and other countries to provide limited nonswitched service (primarily video). The first private cable—PTAT-1—is scheduled for completion across the Atlantic in mid-1989.[13]

The PTAT-1 cable is particularly significant because US Sprint plans to have a 50 percent ownership in partnership with Cable & Wireless.[14] Cable & Wireless is the parent firm of Mercury Communications, which competes for both domestic and international traffic with British Telecom. This arrangement will facilitate agreements between US Sprint and Mercury for handling each other's traffic—including financial settlements that may move away from 50/50 accounting rates and toward cost-based charges along the lines discussed above.

The possible strengthening of Mercury, in partnership with US Sprint, would help to erode the monopoly previously held by British Telecom for access to the United Kingdom, and stimulate reductions in collection rates for service between the two countries. This outcome would make the United Kingdom all the more attractive as a gateway for transit traffic with continental Europe.

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[13]For a discussion of the potential role of private international carriers, see Frieden (1989).

[14]*Telecommunications Reports*, March 13, 1989, pp. 1–4.

Competition in Global Markets

Open access in neighboring countries may so strengthen their telecommunication infrastructure that this development becomes an important consideration in locational decisions by business enterprises. Improved telecommunications infrastructure as a factor in shifting economic activity from one country to another would encourage PTTs to liberalize entry to protect their own countries in the increasingly competitive global marketplace.

Direct Erosion of Monopoly Bottlenecks

Facilities outside the ownership and control of existing dominant common carriers will help weaken the monopoly control of the PTTs. In the case of competing satellite systems, it is possible to bypass the local terrestrial network to work with small earth stations near customer premises. To be sure, requests by satellite entities to provide direct service to bypass PTT facilities can simply lead to refusals. But as the requests mount, the PTT may find it increasingly difficult to say "no." Politically vocal telecommunication users within the country, seeing the potential advantages of direct access, will add pressures to erode the PTT's traditional stance. The U.S. Department of State, the U.S. Department of Commerce, and the U.S. Trade Representative may also play important roles in assisting U.S. carriers to gain a foothold.

For example, Pan American Satellite already has gained limited access to some countries. Such new arrangements will demonstrate the advantages of direct access to customers of the PTTs, helping to bring pressure on the PTTs to further liberalize entry.

IMPLICATIONS FOR U.S. REGULATORY POLICY

The FCC has long been concerned about high accounting rates and the growing outflow of dollars. In response, it launched an inquiry in 1987 to determine what kinds of actions it might take on behalf of U.S. carriers and consumers. It received conflicting suggestions from the carriers and others, and no clear positive program of action has emerged.[15]

Moreover, the FCC has long been concerned with the threat of whipsawing and has pursued the uniform settlements policy and the newer international settlements policy as treated above. It is not clear,

[15]FCC (1988b).

however, that such policies do much good, at least with respect to telephone traffic. To be sure, cases can be postulated in which FCC policy would prevent whipsawing. But, cases of whipsawing can be postulated that would not be prevented by the FCC's policy, because bargaining tools other than accounting rates can be used by PTTs for whipsawing. Moreover, nonuniform rates may be desirable as a way to move toward cost-based settlements among carriers. Finally, even in the absence of whipsawing, the growth of competition on the U.S. side strengthens the bargaining position of the PTTs.

At the same time, the FCC, by authorizing separate satellite systems and private cables, has a potentially very useful tool at its disposal. These systems may contribute to competition among PTTs for U.S. traffic and they may help directly to break through PTT bottlenecks, as discussed above. Such pressures could do more to reduce and restructure accounting rates and collection rates than is possible through the FCC's current international settlements policy.

There is, however, a regulatory hitch. To protect INTELSAT, the FCC has authorized separate satellite systems only on condition that they not be used for switched traffic. Switched traffic constitutes the bulk of international (as well as domestic) traffic. Indeed, it is for that reason that this study singles out switched telephone service for analysis. If the FCC eliminated the ban on switched traffic, it would move another step toward improving economic efficiency in the provision of worldwide telecommunications services.

Although no legal barrier exists to using private cables for switched services, their status has been ambiguous. Common carriers could lease capacity on private cables for switched services. But the basic rationale for the FCC's authorizing private cables was that they would be used for "specialized" services that would help to tap alleged new and large markets for telecommunications services. For this reason, the FCC did not formally consider the use of PTAT-1 when it made decisions about the amount of transatlantic capacity that would be needed into the 1990s in conjunction with its approval of TAT-8 and TAT-9 (to be completed in the early 1990s).[16] Explicit recognition by the FCC of the possible use of private cables for switched services would further promote competition with the incumbent carriers. For example, the joint use of PTAT-1 by US Sprint and Mercury would contribute even more to strengthening the gateway status of the United Kingdom and to increased competition by European PTTs for U.S. traffic, if the cable could freely be used for switched traffic.

[16]For a discussion of the FCC's approval process, under Sec. 214 of the Communications Act of 1934, see Johnson (1988a), pp. 9–15.

Fortunately, the FCC has recently moved in the right direction by clarifying that private transoceanic cables are free to be used for common carrier services.[17]

SUMMARY

Competitors to AT&T have succeeded in negotiating operating agreements with a number of countries. Additional agreements will be signed as the domestic traffic levels of these carriers grow to make agreements advantageous to PTTs.

The emergence of competition creates dangers of whipsawing, which the FCC seeks to prevent by overseeing accounting rates. However, PTTs have tools at their disposal—including threats to reallocate traffic and to terminate operating agreements—in their negotiations with U.S. carriers. With or without uniform accounting rates, monopoly PTTs are in a strong position to extract concessions from U.S. carriers.

Recent increases in the net outflow of dollars may be evidence of the squeeze by foreign PTTs on competing U.S. carriers. These PTTs agree only to slow reductions in accounting rates, while competitive pressures on the U.S. side force larger reductions in collection rates. But growing dollar outflows also occurred when AT&T dealt with foreign carriers on a bilateral monopoly basis. Negotiations that benefit the participating carriers are not necessarily associated with a zero net dollar outflow. Net payments to PTTs are only one of several factors that affect AT&T's earnings. Maximization of profits can be consistent with a large net outflow of dollars.

The bargaining power of PTTs has notable limits. PTTs compete with each other for transit traffic to and from the United States. Investments in new satellite and cable systems will contribute to greater competitive pressures by expanding the possibilities of alternative routings, encourage liberalization by PTTs through the demonstration effect, and help directly to break through PTT monopoly bottlenecks. The FCC can exploit these possibilities by eliminating the ban on carriage of switched traffic by separate satellite systems.

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[17] *Telecommunications Reports*, May 15, 1989, p. 41.

VI. CONCLUSIONS

High accounting and collection rates are key impediments to efficient use of international telecommunications resources. Accounting rates exceed the cost of access to national networks, at least during off-peak periods. This situation results in large net payments by U.S. carriers in excess of the cost to PTTs of completing calls from the United States. Because accounting rates in most countries do not reflect time-of-day use, they discourage the establishment of peak load collection rates that would also improve the efficiency of resource use.

Because collection rates are high relative to costs, the profits of AT&T and foreign carriers for international service are high, at least for the examples shown in this study. Profits from international services are used to reduce domestic telephone rates and, perhaps in some cases, to help support nontelecommunications services. Moreover, collection rates in other countries (converted to dollars) are generally higher than those for AT&T and other U.S. carriers. This situation contributes to the imbalance of originating and terminating traffic, a larger net outflow of dollars, and higher profits for the PTTs.

High accounting and collection rates arise, at least in part, because of the monopoly positions held by most PTTs. Their positions will become stronger as competition grows on the U.S. side. This strengthened bargaining position will likely result in a squeeze on U.S. carriers whose collection rates, driven by competitive forces, will fall relative to accounting rates that the PTTs will seek to maintain at high levels.

The bargaining positions of the PTTs are constrained, however, by the possibilities of moving traffic through third countries, encouraging competition among PTTs with respect to both collection and accounting rates. Completion of new fiber cables and satellite systems, offering lower cost alternative routings and generating other competitive pressures, will further contribute. Lifting the FCC-imposed ban on switched traffic carried on "separate" satellite systems (those that compete with INTELSAT) would further stimulate competition among PTTs and help to reduce collection and accounting rates.

The specific conclusions of this study are:

- Excess profits earned in international services are encouraged both in the United States and abroad because these profits help to reduce domestic telephone rates. This situation is illustrated

by the reluctance of the FCC to separately regulate AT&T's international rates and by price cap regulation in the United Kingdom where international service is not covered.

- Foreign PTTs are generally more reluctant to adopt time-of-day pricing than AT&T because of their concerns about possible loss of revenues. AT&T's more optimistic views may reflect its belief that the price elasticity of demand for its originating traffic is higher than that of foreign-originated traffic.
- The presence of many time zones in East-West traffic is an impediment to improving the efficiency of time-of-day pricing because of (a) the need to have uniform rate periods in local time to aid consumer acceptance, and (b) variations in peak load use within segments of the international network.
- Disparate time-of-day rate structures among countries, resulting apparently from a failure to coordinate their actions, further reduce the efficiency of time-of-day pricing.
- The large and growing net dollar outflow, by itself, is not evidence that the PTTs are in a superior bargaining position relative to the United States. This situation could reflect no more than the common phenomenon where a country imports more of a particular good or service than it exports.
- Facing competitive U.S. carriers, monopoly PTTs might attempt to whipsaw or to play one off against the others for their own benefit.
- Even if PTTs do not explicitly play off one U.S. carrier against another, they are in a strong position to extract concessions from competing U.S. carriers.
- Competition among PTTs and possibilities of customers moving traffic through third countries help to reduce these bargaining advantages.
- It is not clear that the FCC's uniform settlements policy and the newer international settlements policies have strengthened the bargaining position of U.S. carriers because accounting rates are only one of several tools that PTTs can use to disadvantage U.S. carriers.
- By authorizing the construction of "private" cables and "separate" satellite systems in recent years, the FCC has a potentially very useful tool at its disposal, because these facilities may both contribute to competition among PTTs for U.S. traffic and help directly to break through PTT monopoly bottlenecks.
- The FCC can more fully exploit these possibilities by eliminating its ban on carriage of switched traffic by separate satellite

systems. It recently moved in the right direction by clarifying that private cables are free to be used for switched, common carrier traffic.

Appendix

DIRECTIONS FOR FUTURE RESEARCH

This study can only briefly survey major issues of international retail services, which cover a large area previously subject to rather little research. The following describes six subjects that deserve far more extensive treatment than is possible here.

MODELS OF BARGAINING AMONG CARRIERS

A previous study (O'Brien, 1988) has focused on accounting rates, return traffic, and the threat to terminate operating agreements, as elements in the bargaining process. Expanded modeling is needed to examine the comparative results of bilateral monopoly, one-sided competition, and two-sided competition, along with third-country arrangements that constrain the bargaining process. Specific inquiries would include:

- *Effects on U.S. and Global Welfare.* One would generally expect global welfare to increase with an expansion of competition on one or both sides. But an extreme outcome is imaginable where competition on the U.S. side would permit foreign monopoly PTTs to raise accounting rates to maintain U.S. collection rates at the otherwise monopoly level. The United States would be worse off because its consumer surplus would be unchanged, while it would lose producer surplus to the monopoly PTTs, and global welfare would be unchanged. Formal modeling would show the conditions under which this extreme solution would arise, along with other possibilities ranging to the other extreme where the United States gains the full benefit from one-sided competition.
- *The Role of the FCC.* The role of a central regulatory authority within these bargaining models is important to explore. Examples include the effects of the FCC's international settlements policy on bargaining outcomes under varying market structures. Of central concern is how various regulatory interventions affect U.S. and global welfare.

- *Net Dollar Flows.* A key question is whether a plausible bilateral monopoly model could be constructed to show a time path of net dollar outflow roughly coincident with the actual time path of dollar outflow (shown in Fig. 5.1) recorded during the time when AT&T held a monopoly of international voice service. Such evidence would be instructive in demonstrating how bilateral monopolists seeking either to jointly maximize profit or some other objective may end up with a mutually beneficial agreement that results in a steady increase in net dollar outflow. The modeling would then proceed to show how changes in market structure affect dollar flows.

EMPIRICAL EFFECTS OF COMPETITION

As competition continues to grow, the expanding base of cross sectional and time series data will shed light on the effects of competition in comparison with the base case of bilateral monopoly. Several areas are of particular interest:

- *Collection Rates.* Presumably, collection rates tend to fall more rapidly for a country where competition exists. A variety of competitive relationships is emerging, ranging from limited bilateral competition in the U.S.-U.K. market to bilateral monopoly among other countries. Examination of the relationship between rate reductions and market structure between country pairs would be illuminating.
- *Accounting Rates.* The situation with accounting rates is more complex. Under bilateral competition one might expect accounting rates to fall, perhaps to the cost of network use. But the results might be affected by the degree to which traffic flows are balanced and the relative strength of competition between the two country pairs. Comparisons between accounting rate behavior under bilateral competition, one sided competition, and bilateral monopoly would be instructive.
- *Net Dollar Outflow.* Presumably, downward pressure on collection rates as a consequence of competition on the U.S. side will stimulate originating traffic relative to incoming traffic, leading to further increases in net dollar outflow at constant accounting rates. The relationship between growing competition and net dollar outflow should be explored, taking into account many other changes that affect outflows including growing national income, international trade, and expanding possibilities for third-country transit.

- *U.S. and Global Welfare.* In parallel with the examination of theoretical effects of bargaining on welfare, noted above, empirical analysis should be undertaken of how competition is affecting U.S. and global welfare through the effects on costs, pricing, and traffic flows.

ACCOUNTING RATES

Much of this study has focused on problems posed by high and relatively inflexible accounting rates. More analysis is needed of the magnitude of this problem and ways in which it might be alleviated.

- *The Cost of Network Use.* Although analysts concur that accounting rates exceed costs, these costs have not been subject to careful empirical scrutiny. The cost of using international networks for originating and terminating calls should be studied. The methodology might be similar to ones used in studies of common carrier access charges and costs in the United States.[1] This cost would be related to the telephone density of the country, the technological vintage of the network, geographical size of the country, its ease of access to international circuits, time of day, and other variables.
- *Impediments to Time-of-Day Rates.* This study suggests that a barrier to more efficient retail pricing is relatively high accounting rates during off-peak periods. Investigation is needed as to why only few countries have been willing to adopt time-of-day accounting rates. Analysis is also needed of the degree to which adoption of time-of-day rates has encouraged more efficient collection rate structures and efficient use of telecommunication resources.
- *Competition Among Countries.* Investigation is needed of how extensively countries are competing for transit by reducing accounting rates. Empirical analysis is difficult, since accounting rates among countries other than for the United States are not publicly available. But perhaps by tracing changes in the flows of traffic among countries, both directly and through third countries, one can make inferences about the degree of competition taking place.
- *Emergence of New Ownership Arrangements.* Private cable systems and satellite systems owned by newcomers to the international satellite market could have significant effects on

[1]These studies are filed in FCC Docket No. 78–72, *MTS-WATS Market Restructure.*

collection rates and accounting rates among traditional telephone suppliers. For example, how US Sprint's planned 50 percent ownership of PTAT will give it and Mercury expanded reciprocal access to the U.S. and U.K. markets merits more detailed assessment than is possible in this study.

COLLECTION RATES

- *Optimal Time-of-Day Pricing.* Analysis is needed of optimal pricing for international services along the lines of a recent empirical study of time-of-day pricing for local telephone service (Park and Mitchell, 1987). That study would provide guidance about methodology and data sources because local and international networks are similar in key respects. One can visualize a local network as including two central offices connected by a trunk line that, in an international setting, becomes a transoceanic satellite or cable link. A major difference, of course, is that more time zones are usually involved in international service, so that traffic loadings vary more widely at any given time among segments of the international network.
- *Impediments to Time-of-Day Pricing.* Better understanding is needed of why most PTTs resist the notion of time-of-day pricing. Why, for example, has France adopted a three-period rate, but West Germany, in the same time zone, retains a single 24-hour rate? This study suggests the answer probably lies in their differing beliefs about how time-of-day rates would affect net revenues. But we do not know what data they rely upon, the reliability of that data, or why they would expect greater revenue reductions than reductions in costs through more efficient network use.

THE GOALS AND BEHAVIOR OF CARRIERS

A key component of future research is to strive for better understanding of why carriers behave as they do. Do government-owned PTTs seek to maximize profit from international services or do they have other goals? Is the behavior of government-owned PTTs integrated with postal and telegraph services markedly different from the behavior of those that are government-owned but separate entities? How do the goals and behavior of PTTs in advanced countries compare with those of PTTs in less developed countries? Can we detect

differences in their behavior in recent years in comparison with years before the development of competition on the U.S. side? Despite detailed and rigorous analysis that might be conducted of optimal pricing, relating to both collection rates and accounting rates, the analysis would have little practical value unless it took into consideration the goals and behavior of the carriers.

TECHNOLOGICAL INNOVATION

The relationships among market structure, regulatory processes, and technological innovation also merit exploration. The rapid technological advances in international telecommunications (for example, in satellites and fiber optic cable) are similar to those for domestic service. One might hypothesize that international services simply inherit the technologies developed for much larger domestic markets, so that technological advance is an exogenous process in international markets. On the other hand, INTELSAT in its early years funded much R&D directed specifically to international service. It would be useful to examine how the increasingly competitive market structure, reduced regulatory oversight, and market growth affect, and are affected by, technological advances in the international arena.

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Telephone Demand Over the Atlantic

Evidence from Country-Pair Data

Jan Paul Acton, Ingo Vogelsang

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Evidence from Country-Pair Data

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PREFACE

This report examines the determinants of international calling, both theoretically and empirically. It centers particularly on the role of prices to and from the United States and explains the volume of calling across the North Atlantic market. This market is important for economic and policy reasons, since the governments play a role in setting prices and terms of access; the net impact of calling affects the balance of payments between country pairs. The study is based on recent data on call use, along with detailed information about pricing structures. The period of analysis was one of rapid expansion in calling, important price changes, and deregulation of services in some countries. Consequently, these recent price estimates may be particularly relevant for contemporary policy deliberations.

The report should be of interest to domestic and foreign telecommunications carriers, and to regulatory and legislative bodies in the academic research community.

This work is funded under grants from the National Science Foundation (Dr. Laurence C. Rosenberg, Project Monitor) and The Markle Foundation. A related study, *Competition, Pricing, and Regulatory Policy in the International Telephone Industry*, R-3790-NSF/MF, by Leland L. Johnson, July 1989, was also prepared under the same grants.

SUMMARY

International telephone calls are important as an economic good, and they play a significant role in balance of payment. In recent years, U.S. carriers received over $3 billion in revenues for their overseas calls. Because international calling requires payments to the country where the call terminates, transfer payments from U.S. carriers must also be made (and reciprocal payments for calls terminating in the United States). In recent years, the net payment by U.S. carriers to foreign telephone systems was in excess of $1.2 billion.

The demand for telephone calls is similar in many ways to the demand for other goods and services, but some added considerations are important. Since calls involve two parties, calling can generate externalities (positive or negative). That is, both parties can benefit or lose from a call, even though only one party pays for it. Furthermore, the price for initiating a call generally differs from country to country, so the opportunity exists to lower the cost if the two parties agree to initiate their call from the lower priced country. We designate these two features as "call externalities" and "arbitrage," respectively. The practical significance is that one or both of these features may be present in international calling, and they may affect the normal working of price changes on the quantity of calls originating in the United States and in other countries. A change in the price of outbound calls in one country can affect the volume of both outbound and inbound calls.

The empirical analysis is based on annual data for minutes of calling between the United States and 18 West European countries from 1979 to 1986. We examined the volume of calls both originating and terminating in the United States as a function of the price in the country of origin (the "own-price" effect) and the price in the country where the call terminated (the "cross-price" effect). In addition, we allowed for economic and conditioning variables such as the volume of trade between the countries, the percentage of employment in major sectors of the economy, the number of telephones, and the price of telex services (a potential alternative form of communication).

In 1979–1986, the price for calling to and from the United States fell in nominal terms for most countries and it fell in real (adjusted for inflation) terms for all countries. In general, it was less expensive to initiate a call in the United States throughout this period than to terminate one, although the differences have shrunk, especially since 1982.

We concentrated specifically on the role of price and tested the effects of several alternative specifications of price in the demand equations. Following economic theory, we selected marginal price as influencing the quantity of calling—rather than the inframarginal charge (say, the higher price for the first minute of calling) or the average price. Empirically, in this sample, marginal price and average price have fairly similar effects on the demand for calls. We also examined the effects of expressing prices in the currency of the country of origin or in U.S. dollar equivalents. The latter would be especially appropriate if arbitrage were a significant consideration. Expressing prices in each country's units strengthened the effects of European prices on calls terminating in the United States and diminished slightly the effect of U.S. prices on those calls. It also weakened the effect of other countries' prices on calls originating in the United States.

Overall, the price for calling from the United States produced negative, but statistically insignificant, coefficients on the minutes of calling from the United States in 1979–1982, and negative, significant coefficients equal to approximately −1.0 in 1983–1986. The price for calling to the United States likewise produced a negative coefficient on minutes of calling to the United States. The coefficient generally has values between −0.3 and −0.5 and is statistically significant in both 1979–1982 and 1983–1986. Cross-price effects—the effect of U.S.-origination prices on the volume of calls to the United States (and vice versa)—are always negative when they are statistically significant. This implies that the inbound and outbound calls are economic complements. The pattern is consistent with our call-externality theory developed in Sec. III.

Most other explanatory variables yield expected coefficients on the volume of calls and the country of origin. The interesting—possibly unexpected—finding of a negative effect of telex prices on the number of calls is consistent with a business practice of requiring a telex confirmation for certain commercial transactions or communications; calls and telex services are economic complements. Thus, a rise in telex prices acts in the same manner as a rise in telephone prices. We also found a strongly positive coefficient on the number of telephones in each country. This structural variable obviously facilitates calling and seems to be acting as a proxy for income—which we omitted from our specification because of multicollinearity.

Empirical results such as the ones we present can be useful in many possible policy applications. Perhaps most important, they can help regulators and suppliers of telephone services to anticipate the effects of price changes on call volume. The estimates also provide a possible explanation for some of the puzzling pricing practices we observe in

U.S. international telephone carriers. For example, some off-peak rates for calls originating in the United States are below the accounting rates that U.S. carriers are required to pay their foreign counterparts for those calls. This would suggest, on the face of it, that such rates are set below marginal cost. However, if the cross-price effects are strong enough to stimulate a sufficient volume of return calls from outside the United States, for some values of prices and price elasticities the practice becomes rational because of the effect on total revenue.

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CONTENTS

PREFACE iii

SUMMARY v

ACKNOWLEDGMENTS ix

FIGURES AND TABLES xiii

Section

I. PURPOSE AND MOTIVATION OF THE REPORT 1
Overview of the Report 2

II. BROAD TRENDS IN INTERNATIONAL TELECOMMUNICATIONS SUPPLY AND PRICING 3
Nature of Pricing for International Telephone Calls 6
Payments Between Telephone Carriers 8

III. INTERNATIONAL TELECOMMUNICATIONS SERVICES AS AN ECONOMIC GOOD 10
The Likely Size of the Call Externality 11
Equilibria with Call Externalities 13
Arbitrage Without Interdependent Utility 16
Joint Utility Maximization 20
Interaction of Externality and Arbitrage 23
Policy Consequences 25
Other Services 26

IV. MODELING, ESTIMATION, AND DATA CONSIDERATIONS 27
Modeling 27
Choosing Share or Quantity as the Dependent Variable .. 28
The Data 29

V. EMPIRICAL RESULTS 31
Principal Effects in the Quantity Regressions 31
Effects of the Inframarginal Charge 35
Effects of Using Average Price 36
Effects of Stating Prices in Each Country's Currency ... 38
Results from Estimating Share Equations 41

VI. CONCLUSIONS 43
Principal Empirical Results 43
Policy Relevance of the Findings 44

Appendix: ADDITIONAL COEFFICIENTS 45

REFERENCES 47

FIGURES

1. Trends in prices of direct calls to the United States 3
2. Trends in relative prices of direct calls from the United States and from France 4
3. Trends in relative prices of direct calls from the United States and from West Germany 5
4. Trends in relative prices of direct calls from the United States and from the United Kingdom 5
5. Trends of international calls to the United States 6

TABLES

1. Prices of marginal minute of international calls between the United States and selected countries 7
2. Illustration of international telephone rates in 1986 8
3. Estimated coefficients when marginal price is used as an explanatory variable 33
4. Estimated coefficients when inframarginal price is used as an explanatory variable 37
5. Estimated coefficients when average price is used as an explanatory variable 39
6. Estimated coefficients when telephone prices are stated in country's currency 40
7. Share equations, using either marginal or average price ... 42

A.1. Values for country-specific dummy variables and autocorrelation corrections for Table 3 45

A.2. Values for country-specific dummy variables and autocorrelation corrections for Table 6 46

I. PURPOSE AND MOTIVATION OF THE REPORT

We chose to study international telecommunications demand as an economic good and because of the policy issues surrounding it. In aggregate, international telephone-service demand is a $3 billion market for U.S. carriers alone and probably exceeds $2 billion for foreign countries as well.[1] International telecommunications resulted in a net payment of $1.2 billion in 1986 by U.S. carriers to foreigners, which—considered in isolation—contributes to the U.S. balance-of-trade deficit.[2]

Telecommunications demand is applicable to policy analysis because the prices charged are subject to review or regulation in all countries, and in other instances, the government—through post, telegraph, and telephone services (PTTs)—supplies the services itself. Thus, the government is involved in reviewing capacity and pricing decisions for international telecommunications supply. Furthermore, in some instances, governments consciously use excess revenues from international telephone calls to subsidize other telecommunications services or to contribute to general revenues.[3] The result is that pricing and demand are subjects for explicit policy analysis in the United States and abroad.

The telecommunications market has changed substantially in recent years. Technology has permitted significant increases in capacity and quality of service while permitting lower costs per call. The volume of voice traffic in particular has grown substantially, and aggregate capacity for handling international calls has grown even more dramatically. In recent years, competitive suppliers have entered the market, and customers on some routes have a choice. Partial deregulation in the United States has led to this increased competition and to a richer variety of pricing schedules in some international markets as well.

Despite the policy significance of the market and these recent substantial changes, relatively few public studies have been made of the demand for international telephone calls. Most such studies include

[1]Federal Communications Commission (1987c), Table 1.

[2]Federal Communications Commission (1987c). Trade in other goods and services may be associated with international telecommunications as well, so the net effect on balance of payments is not easily determined.

[3]See Johnson (1987) or Bruce, Currand, and Director (1986) for discussions of some aspects of governmental involvement in this arena.

data through only the late 1970s, before the most recent increases in supply, the fall in prices for many services, and the deregulation of long distance service in the United States.[4] Telecommunications policy analysis would benefit from better understanding of demand in order to: project future levels and usage patterns, estimate likely deficits or surpluses, examine the effects of alternative pricing policies on use and capacity and on economic welfare, and so forth. The purpose of the present report is to contribute in a preliminary way to such understanding, using recent data across the heavily used North Atlantic market.

OVERVIEW OF THE REPORT

In Sec. II, we briefly summarize broad trends in the industry in recent years. Next, we discuss the nature of international telecommunications demand as an economic good, emphasizing the features that make such calls somewhat different from conventional goods. In Sec. IV we discuss our modeling and estimation approach and describe the data available for our analysis. In Sec. V we present the empirical results and in Sec. VI our conclusions.

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[4]Previous international studies include Lago (1970), Yatrakis (1972), Craver (1976), Rea and Lage (1978), Appelbe, Larson, and Lehman (forthcoming), and Appelbe et al. (forthcoming).

II. BROAD TRENDS IN INTERNATIONAL TELECOMMUNICATIONS SUPPLY AND PRICING

Telecommunications include voice, data, telex, and telegraph services. We concentrate on voice communications using public, measured services, which are the largest component in dollar terms. We allow for telex services as a potential substitute or complement, but do not examine other services in this report.

The price of international calling has fallen substantially in nominal and real terms over the last decade. Figure 1 gives an abbreviated summary of the trends in prices for selected West European countries. Prices are for one minute of direct international calling to the United States, converted to U.S. dollars.[1] These prices fell by roughly 50

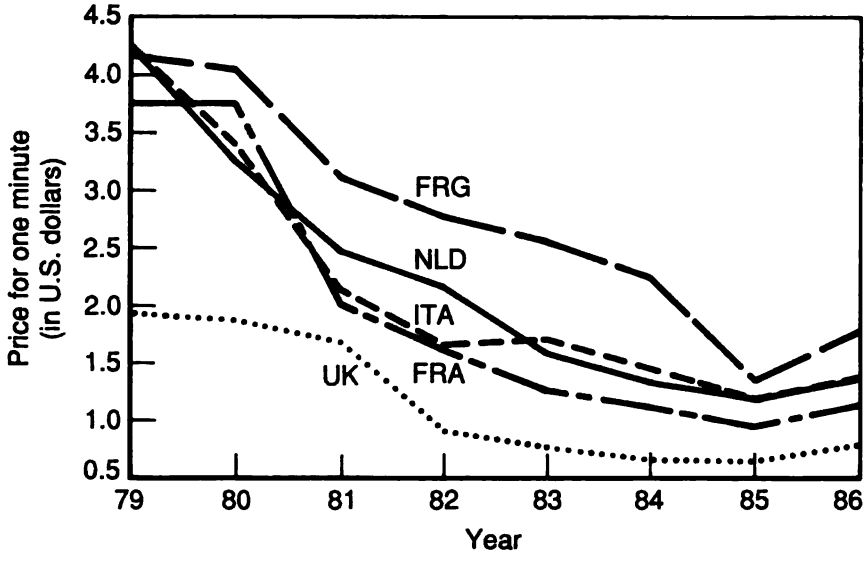

Fig. 1—Trends in prices of direct calls to the United States

[1]All price variables are constructed to reflect the average price paid over a calendar year. If a rate changes during the year, a weighted average of prices is taken, where weights are number of months.

percent for each country from 1979–1986. Rates from most countries began the period at about $4.00 per minute (after the initial one- or three-minute period) and fell to less than $2.00 per minute by the mid-1980s. The price for calling from the United Kingdom was substantially lower throughout this period, but it too fell by over 50 percent.

The cost of a comparable call from the United States to these countries started much lower than the European rates, but the difference has narrowed. Figures 2 through 4 illustrate the trend for three countries. France, like many other countries, started the period at about twice the U.S. price level, but ended it about the same when stated in U.S. dollars. The Federal Republic of Germany has always had higher rates, although the difference has narrowed substantially. Rates between the United States and the United Kingdom have been very close throughout the period.

At the same time, the volume of international calls has increased substantially—aided no doubt by the expansion of capacity and the widespread introduction of direct international dialing. Figure 5 presents highlights of these trends for selected countries.

Table 1 gives prices for a marginal minute of an international call in both local and U.S. currency, and for calls originating in both the United States and the European countries. As prevously noted,

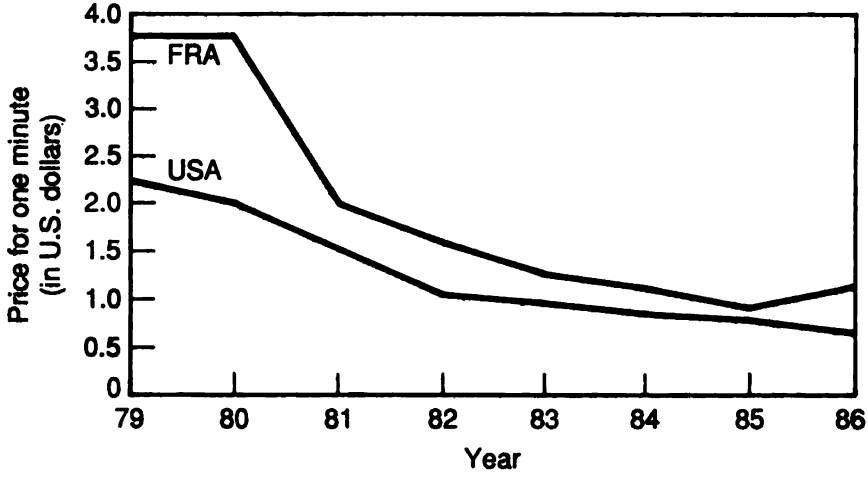

Fig. 2—Trends in relative prices of direct calls from the United States and from France

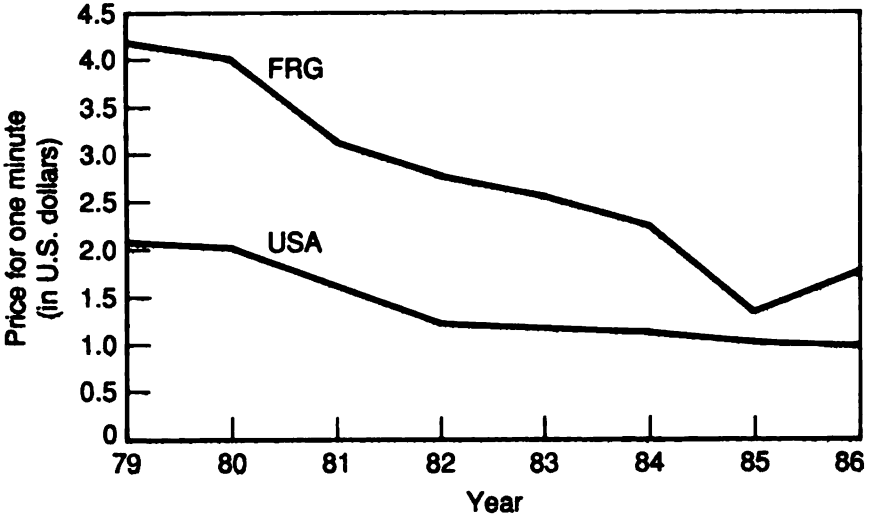

Fig. 3—Trends in relative prices of direct calls from the United States and from West Germany

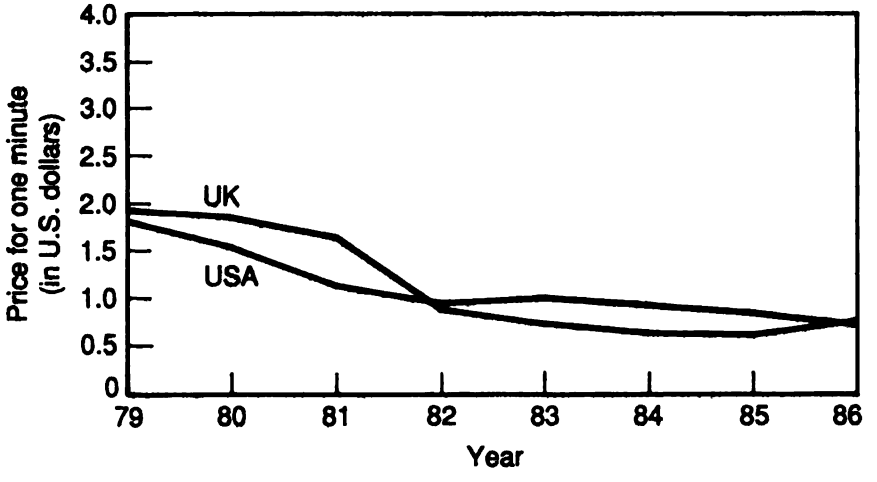

Fig. 4—Trends in relative prices of direct calls from the United States and from the United Kingdom

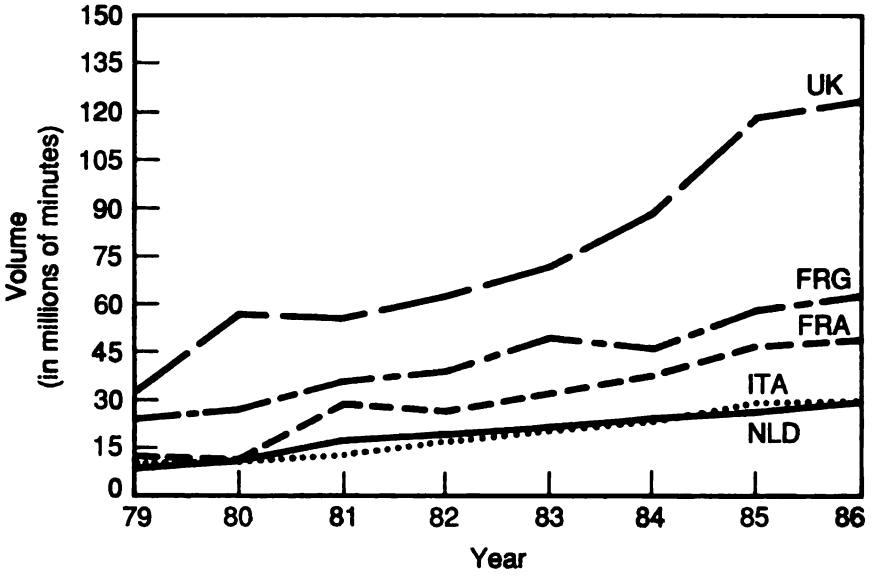

Fig. 5—Trends of international calls to the United States

marginal-minute prices are generally lower for calls originating in the United States.

NATURE OF PRICING FOR INTERNATIONAL TELEPHONE CALLS

Broadly speaking then, it is less expensive to call from the United States to European countries than vice versa, but this masks some important distinctions. As suggested in Table 2, European rate structures generally make very short calls less expensive than the same length call placed in America; but for longer calls, the total cost of the call becomes lower for calls originating in the United States.[2]

This is due to several features of the rate structures. Rates in the United States are higher for the first block of time (three minutes in the earlier period, now one minute) and lower per minute for additional minutes. Furthermore, the United States charges for each fraction of a minute at the whole-minute rate. European rates generally do not

[2]See Federal Communications Commission (1987c) for a recent review of the relative costs of calls of different lengths in 1986.

Table 1

PRICES OF MARGINAL MINUTE OF INTERNATIONAL CALLS BETWEEN THE UNITED STATES AND SELECTED COUNTRIES

Country	1979			1986		
	Local Currency		Real U.S. Dollars	Local Currency		Real U.S. Dollars
	Nominal	Real		Nominal	Real	
To the United States from:						
France	14.07	15.788	3.715	12.833	7.903	1.141
Germany	7.333	7.685	4.193	4.656	3.866	1.781
Italy	2905.86	3505.88	4.219	4214.56	2048.38	1.374
Netherlands	8.00	8.44	4.209	3.96	3.35	1.368
United Kingdom	0.750	0.898	1.906	0.742	0.517	0.759
From the United States to:						
France	2.00	—	2.182	1.09	—	0.819
Germany	2.00	—	2.182	1.22	—	0.920
Italy	2.00	—	2.182	1.09	—	0.819
Netherlands	2.00	—	2.182	1.09	—	0.819
United Kingdom	1.50	—	1.636	1.05	—	0.791

SOURCES: Eurodata *Voice Book*, various years; and ATT rate schedules, various years, private communication.

NOTE: Real values are calculated so that real equals nominal in 1980.

have a declining price per minute; instead the same per-minute price applies to short and long calls. Moreover, European countries generally charge only for the fraction of a minute that is used, which further reduces the price of shorter calls relative to calls originating in the United States. This policy of charging for only a fraction of a minute—combined with lower first-minute rates—encourages brief "call me back" calls from Europeans to Americans (see Sec. III for a discussion of gift and arbitrage motivations for calling).

Other distinctions between U.S. and European international rates may affect bills as well. In the United States, customers pay different prices during peak, shoulder, or off-peak periods, while European customers generally face only peak or off-peak prices. In some instances (notably West Germany), customers pay the same price for international calls at all hours. Unfortunately, the data available for our estimation do not distinguish calls by the time at which they were placed.

Table 2

ILLUSTRATION OF INTERNATIONAL TELEPHONE RATES IN 1986

Country	Prices in U.S. and Country-of-Origin Currencies
	To the United States from:
France	Price:[a] 10.04 fr/min Period: 4.6 sec Equivalent U.S. price: $1.45/min
Germany	Price: 0.23 DM/2.964 sec Equivalent U.S. Price: $2.14/min
United Kingdom (Brit Tele)	Peak:[b] 65 p/min Standard: 59 p/min Cheap: 51 p/min Equivalent U.S. Price: $0.96/min for peak

Country	Call Type[c]	Price of Initial Minute (In U.S. dollars)	Price of Additional Minutes (In U.S. dollars)
	From the United States to:		
France	Standard	1.94	1.09
	Discount	1.46	0.82
	Economy	1.16	0.65
Germany	Standard	2.17	1.22
	Discount	1.63	0.93
	Economy	1.30	0.73
United Kingdom	Standard	1.65	0.99
	Discount	1.23	0.75
	Economy	0.99	0.60

SOURCE: Eurodata Foundation, 1986.

[a]Reduced by 7/30ths from 8 pm to 2 am; reduced by 39.5 percent from 2 am to 10 am.

[b]Peak - 3 pm to 5 pm, Monday through Friday; standard - 8 am to 8 pm, excluding peak hours, Monday through Friday; cheap - all other hours.

[c]Standard - 7 am to 1 pm, discount - 1 pm to 6 pm, economy - 6 pm to 7 am.

PAYMENTS BETWEEN TELEPHONE CARRIERS

The mechanism by which telephone companies earn money from international calls is complex. It involves both collections from customers placing the calls and settlements among international carriers—called accounting rates. If traffic in and out of two complementary

countries is balanced, these charges cancel one another; otherwise, the country initiating the most calls pays.[3] With few exceptions, U.S. carriers make net payments to other international telephone carriers. Because inbound traffic earns foreign countries hard currency, they have an incentive to cause traffic to be inbound. In recent years, payments by U.S. telephone carriers to foreign telephone carriers have exceeded $2.3 billion per year; receipts from foreign carriers have exceeded only $1.1 billion for a net payout of over $1 billion.

Although these international settlements are important to the telephone carriers—and they affect the balance of payments between the United States and its trading partners—they have little direct significance for our demand estimation. The customer faces a posted price and is unconcerned with the manner in which revenues are divided between the U.S. carrier and the international telephone carrier. Indirectly, however, international settlements and telephone tariffs are and should be interdependent.

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[3]See Dansby and Luciano (1987) for a description of this settlement process.

III. INTERNATIONAL TELECOMMUNICATIONS SERVICES AS AN ECONOMIC GOOD

International telecommunications are a rapidly growing service industry providing for increasing international trade in goods and other services. This in itself may not justify the study of international telecommunications demand. In addition, some methodological and empirical peculiarities challenge research efforts.

Telecommunications—and telephone calls in particular—are different from many economic goods. A call requires two (or more) parties for the good to be "consumed." Thus, economists for a long time noticed the presence of two types of externalities in telecommunications demand. Until very recently only one of these has been the subject of empirical work: the network or access externality created by adding a further subscriber to the telecommunications network. Such a new subscriber increases the value of the network to others because she can now also call or be called. The second type of externality is created by calling a party that does not have to pay for being called.

This call externality has been neglected in the literature for three reasons.[1] First, the value of being called is hard to determine empirically. Second, as Littlechild (1975) has argued, parties regularly calling each other are likely to establish a quid-pro-quo or gift relationship, thus internalizing the call externality. At the same time Littlechild suggests that the number of irregular calls is closely related to the size of the network, so that the call externality can be captured simultaneously with the network externality. Third, much of the analysis has considered local calling, where—at least in the United States—the marginal price of calling is often zero. This is not true of long distance or international calling.

In contrast, in international telecommunications the call externality is worth special attention. It is likely to be substantially more important here than domestically because the fairly high tariffs reduce nuisance calls and increase incentives for free riding by those who want to be called rather than initiate the call. Also, as illustrated by Table 1, the difference in point-to-point tariffs between both directions can be quite substantial. Thus, call externalities are more likely to prevail internationally because internalization is more difficult than domesti-

[1]Larson, Lehman, and Weisman (forthcoming) have included call externality in their model but without naming it as such.

cally. If this is so, welfare effects from these externalities gain in importance because asymmetric benefits may accrue to foreign and domestic callers. For example, if in domestic calls the call externality is internalized by party D's paying for party F's benefit, then domestic social surplus is unequivocally increased.[2] If, however, D is the domestic caller and F the foreign receiver, this may well reduce domestic welfare (although it will improve world welfare).

Thus, we are interested in answering the following questions:

1. What is the nature of the call externality; in particular, how can we derive proxies or boundaries for its size with the tools of consumer-demand theory?
2. Under what conditions are consumers likely to internalize the externality, and what are the equilibrium outcomes short of internalization?
3. How can we empirically determine the existence and measure the size of this externality?
4. How does the presence of a call externality affect welfare considerations, in particular, for optimal pricing?

THE LIKELY SIZE OF THE CALL EXTERNALITY[3]

A telephone call can have different characteristics in different situations. Larson, Lehman, and Weisman (forthcoming) capture these characteristics in final consumption-good "information" that is produced in a household production function with outgoing and incoming telephone calls as inputs. This is a roundabout approach that may pay off once we have some idea of the nature of this production function. With as little as we know about it we might as well restrict ourselves to a single black box that is the utility function.[4] Physically, telephone calls are always an exchange of information. In a broad economic sense, however, they can have characteristics of direct consumption pleasure, information, or action. Are there major differences among these cases with respect to the call externality?

Hearing the voice of someone you love clearly provides *direct consumption pleasure*. This is likely to be reciprocal and to be accompa-

[2]To the extent that the richer person acts as the altruist, there is even going to be a distributional gain in addition to the surplus gain.

[3]In the following, we totally ignore access externalities. These may play some role, for example, if less-developed countries are involved. However, even there, access to the network is rarely directly affected by international tariffs.

[4]This does not mean that the production function approach would not be fruitful, for example, for firms as parties to telephone calls.

nied by altruistic behavior. Thus, as demonstrated below, chances are good that under the pleasure characteristic, call externalities may be internalized. On the other hand, the party being called may (altruistically) reduce the duration of the call in order to save the caller money. If both had the possibility to share the cost of the call in proportion to their utility gain, they might talk longer and call more often. Expressed in willingness to pay, the values of calling and being called may be quite different under the pleasure characteristic. This kind of problem and possible solutions are clearly accessible to economic experimentation.

Calling an airline for fares and flight schedules or calling a doctor for the results of a test are clearly *informational* calls. The value to both sides here may be quite asymmetric. That is why the airline will have an 800 number and the doctor may have an unlisted home number. Still, informational exchange is likely to benefit both parties. The person receiving the information will benefit from it while the other side will receive some exchange value in terms of a fee, business, or future information. Informational exchange is likely to have equal expected value for both sides in integrated multinational companies.

Buying a flight ticket or remotely switching on the heating in a weekend home are *actions* that can be effected by means of the telephone. The mutual benefit of an action usually goes further than that of pure informational exchange. The airline sells a ticket rather than providing only flight information. Again, action-related calling in integrated multinational companies should have an equal expected value for both sides.

To sum, the call externality (and its potential internalization) has some importance for all three types of calls. With the exceptions of multinational companies and families, willingness to pay for calling and for being called is rarely going to be equal. In fact, if "free-rider" considerations are absent and point-to-point tariffs are symmetric, callers will self-select to be those with the higher willingness to pay.

This gives us a convenient upper bound for the *marginal* social willingness to pay for calls. By revealed preference, an upper bound would be the sum of the tariff rates of the calling and the receiving parties. On the other hand, a lower bound of the marginal social willingness to pay for a call would be the tariff rate of the caller.

Both of these boundaries hold in an expected value sense. Calls, especially information-related calls, may be worth much more to the person being called than the tariff rate indicates but often this is known only after the call. Of course, one may receive a nuisance call with negative value, but when picking up the telephone the expected value is still positive.

EQUILIBRIA WITH CALL EXTERNALITIES

Internalizing externalities usually requires some prior communication and agreement. Since call externalities occur in situations of small numbers of participants (bilateral monopoly), internalization or bargaining about the externality is not unlikely. Before characterizing these possibilities, let us follow Larson, Lehman, and Weisman (forthcoming) in deriving demand functions for outgoing calls for D (the domestic consumer) and F (the foreign consumer) from solving for the Nash equilibrium in quantities. We currently restrict ourselves to the individual level. The quantity of telephone calls originating domestically is denoted Q_D, and the quantity originating in the foreign country is Q_F. In this section a change in Q shall mean a change in the volume of calls (an increase in the number, an increase in the length, or both).

The domestic consumer maximizes $U_D = U_D(X_D, Q_D, Q_F)$ subject to $Y_D \geq X_D + P_D Q_D$ and $Q_F \leq Q^*_F$. Here Y_D is income and X_D is other expenditure by the domestic consumer. The volume of incoming calls Q^*_F is taken as given for the moment. Thus the consumer maximizes the Lagrangian function:

$$L_D = U_D(X_D, Q_D, Q_F) + \mu_D(Y_D - X_D - P_D Q_D) + \gamma_D(Q^*_F - Q_F) \quad (1)$$

where μ_D and γ_D are Lagrange multipliers. First-order conditions are:

$$\frac{\partial L_D}{\partial X_D} = \frac{\partial U_D}{\partial X_D} - \mu_D = 0 \quad (2)$$

$$\frac{\partial L_D}{\partial Q_D} = \frac{\partial U_D}{\partial Q_D} - \mu_D P_D = 0 \quad (3)$$

$$\frac{\partial L_D}{\partial Q_F} = \frac{\partial U_D}{\partial Q_F} - \gamma_D Q_F = 0\,, \quad \frac{\partial U_D}{\partial Q_F} \geq 0 \quad (4)$$

$$\frac{\partial L_D}{\partial \mu_D} = Y_D - X_D - P_D Q_D = 0\,. \quad (5)$$

Condition (4) says that the domestic consumer will only accept calls from which he expects to gain positive marginal utility (free disposal of incoming calls). All other conditions are the same as in usual demand analysis for other goods.

Consumer F in the foreign country faces a problem similar to D's. Thus, we only have to replace subscript D by subscript F in Eqs. (1) through (5) to state F's problem and first-order conditions. This gives us a way to characterize Q^*_F. Simultaneous solution to D's and F's

maximization problem gives a Nash equilibrium Q^*_D, Q^*_F:

$$Q^*_D = f(Y_D, P_D, Q^*_F) \text{ and } Q^*_F = g(Y_F, P_F, Q^*_D) .$$

Such an equilibrium will generally exist only if both consumers, D and F, are not saturated with respect to incoming calls. Otherwise, at least one consumer would be able to control the variable set by the other. We believe, however, that it is unlikely that incoming calls are rejected. We are interested in the comparative statics properties of this equilibrium, in particular dQ^*_D/dQ^*_F and the cross elasticities ϵ_{DF} and ϵ_{FD}.

Larson, Lehman, and Weisman (forthcoming) characterize $dQ^*_D/dQ^*_F < 0$ as the case of "information content" while they name $dQ^*_D/dQ^*_F > 0$ as the case of "reciprocity." "Information content" shall mean that what matters is the amount of information exchanged, and that is independent of who calls. "Reciprocity" shall mean that calls have value only if the other side has called back. Without this informational background let us ask how the sign of dQ^*_D/dQ^*_F is related to conventional economic notions of substitutability and complementarity. From the Larson, Lehman, and Weisman characterization it may appear that "information content" means substitutability while "reciprocity" means complementarity. This may be empirically correct, although it is not necessarily so in theory.

Consider perfect substitutes: From D's point of view outgoing and incoming calls would be perfect substitutes in the utility function if they could simply be exchanged without affecting utility. In other words, at all levels $\partial U_D/\partial Q_D = \partial U_D/\partial Q_F$.[5] Now, what happens to D's maximization problem if we increase Q_F by a small amount, dQ_F? First, D's total utility goes up by approximately $P_D dQ_F$ units because P_D is what D was willing to pay for the last unit of Q_D. Second, there is a substitution effect in favor of Q_F and against Q_D and X_D. The substitution effect is $dQ_D = -dQ_F$. Third, there is an income effect because the real income of the consumer has increased by $P_D dQ_F$ units. This income effect could be positive and theoretically may more than compensate for the negative substitution effect.

On the other hand, if outgoing and incoming calls are strict complements, we have $U_D(X_D, Q_D, Q_F) = U_D(X_D, \min\{Q_D, Q_F\})$. This introduces a nonconvexity in the indifference curve between Q_D and X_D. Now, assuming nonsaturation in telephone calls, an increase in Q_F will always lead to an increase in Q_D. The question is whether this holds for any degree of complementarity. The problem is that complemen-

[5]This characterization implies that they are also perfect substitutes in the sense of infinite cross elasticities. However, in our case incoming calls have a price of zero and are constrained in supply.

tarity is only easy to define with respect to cross elasticities but not with respect to utility functions. A hypothetical experiment would have to be run in which D would determine the quantity of incoming as well as outgoing calls and pay for both. Complementarity would, in this case, be defined by a negative cross elasticity ϵ_{DF}. In reality, however, D is only paying for her outgoing calls. An increase in P_F would via ϵ_{FF} lead to a decrease in Q_F. This would increase the shadow price of incoming calls for D, but probably by a lesser amount than the change in P_F that caused it. This change in shadow price will have a substitution effect and an income effect.

The substitution effect is the same per unit of price change as in our hypothetical experiment. However, the observed income effect is going to be much larger than the hypothetical one. Thus, negative cross elasticities in the hypothetical experiment easily translate into negative observed cross elasticities, while positive cross elasticities do not. Assuming that telephone calls are a normal good, negative observed cross-price elasticities are quite likely. Thus, $dQ^*_D/dQ^*_F < 0$ implies substitutes while $dQ^*_D/dQ^*_F > 0$ is compatible with complements as well as substitutes.[6]

Now, own-price elasticities are as follows: An increase in P_F will decrease Q_F. If $1 \geq dQ_D/dQ_F > 0$ and $1 \geq dQ_F/dQ_D > 0$, then the demand function $Q_D(P_D, Q_F)$ with adjustment of Q_F is going to be more elastic in P_D than the demand function $Q_D(p_D, Q^*_F)$ with fixed Q^*_F. Also, outgoing and incoming calls will look like complements: $\epsilon_{DF} < 0$ and $\epsilon_{FD} < 0$. Similarly, if Q_D and Q_F are perfect substitutes in D's and F's utility functions, demand with adjustment of the other's quantity will be flatter than without such an adjustment. Furthermore, $dQ_F/dQ_D \geq 0$, $dQ_F/dQ_D \leq 0$, $dQ_D/dQ_F \geq 0$, and $dQ_D/dQ_F \leq 0$ are possible in this case; that is, cross elasticities may have either sign. Note that observed nonzero cross elasticities here come about without either of the consumers having the choice of initiating incoming calls.

We can confirm these relationships more easily for specific functional forms. In particular, let us assume log linear demand equations of the form:

$$\log Q_D = a_D + b_D \log P_D + c_D \log Q_F + d_D \log Y_D \qquad (6)$$

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[6]This characterization also means that in theory "information content" as a label for $dQ^*_D/dQ^*_F < 0$ and "reciprocity" for $dQ^*_D/dQ^*_F > 0$ are misnomers. The statement that only information content matters is compatible with $dQ^*_D/dQ^*_F > 0$. Empirically, however, one may expect income effects to be small since international telephone costs make up a small fraction of people's budgets.

$$\log Q_F = a_F + b_F \log P_F + c_F \log Q_D + d_F \log Y_F \ . \qquad (7)$$

Eliminating the endogenous variables Q_F and Q_D on the right-hand side of these equations, we get the following elasticities:

$$\epsilon_{DD} = \frac{b_D}{1 - c_D c_F} \text{ and } \epsilon_{FF} = \frac{b_F}{1 - c_F c_D}$$

$$\epsilon_{DF} = \frac{c_D b_F}{1 - c_D c_F} \text{ and } \epsilon_{FD} = \frac{c_F b_D}{1 - c_F c_D} \ .$$

We can safely assume that c_D and c_F have the same sign and an absolute value smaller than one. Therefore, the own-price elasticities with call externalities tend to be larger than without such externalities. This is an application of the Le Châtelier principle, which accounts for the price elasticity of the demand for one good rising as more complements and substitutes are available. Cross-price elasticities will tend to be smaller in absolute value than the corresponding own-price elasticities; that is:

$$| \epsilon_{FF} | > | \epsilon_{DF} | \text{ and } | \epsilon_{DD} | > | \epsilon_{FD} | \ .$$

The problem described so far is very similar to a duopoly problem. As there, the Nash equilibrium in quantities is only one of the possible outcomes. D and/or F might also act as Stackelberg leaders or they could hold some (consistent) conjectural variations about each other's behavior. In this case $Q_F = Q_F(Q_D)$ would become part of D's optimization problem in Eq. (1).

ARBITRAGE WITHOUT INTERDEPENDENT UTILITY

In the approaches presented so far, nonzero cross elasticities between incoming and outgoing telephone demand could only occur with at least one nonvanishing cross term, $\partial U_D/\partial Q_F$ or $\partial U_F/\partial Q_D$, in the utility functions. However, in reality, cross elasticities could also become substantial if differences in international telephone rates invite arbitrage.

With perfect arbitrage and no interdependence between D's and F's utility, any such price difference would shift all calls to the country with the lower telephone tariffs. Under this scenario, cross elasticities ϵ_{DF} and ϵ_{FD} would have three distinct ranges:

Cross Elasticity	For: $P_F > P_D$	$P_F = P_D$	$P_F < P_D$
ϵ_{DF}	0	∞	ϵ_{DD}
ϵ_{FD}	ϵ_{FF}	$-\infty$	0

Here ϵ_{DD} and ϵ_{FF} are the hypothetical own-price elasticities of demand if arbitrage were impossible.

Perfect arbitrage is highly unlikely for international telephone calls. At least some transaction costs will have to be incurred in order to assure that the party with the lower tariff will initiate a call. Also, the party paying for the call will have to bill the other party. While determining bills and payments leads to fixed transaction costs, the costs of coordination are variable. And they usually involve telephone call time. The party that wants to be called, say F, has to make this wish known to the other side, D. The wish can, for instance, be communicated through a short "call me" call (Method I), or it can be stated at the end of the last call (Method II). In the following we assume that all rents from arbitrage are captured by F.[7]

Under Method I, transaction costs per call would be

$$T^I = Q_F^{min} E_F P_F + \underline{c}$$

where Q_F^{min} = time required to initiate a call from D,
$\underline{c}$ = fixed transaction cost per arbitraged call, and
E_F = exchange rate.

Introduction of the exchange rate is important here because the arbitrage gain is a financial one (not a utility gain). Thus, a change in the exchange rate has an effect on arbitrage opportunities. The telephone tariff P_F is assumed to be linear in time, and $P_F > P_D$. Now there is a critical length of call for F at which point she would transfer all longer calls to D and make all shorter calls herself. This length is

$$\hat{Q}_F = (Q_F^{min} E_F P_F + c)/(E_F P_F - P_D) \quad . \tag{8}$$

[7]If rents are split on a 50/50 basis, the results would change little.

First derivatives of this critical value with respect to $E_F P_F$ and P_D are

$$\partial \hat{Q}_F / \partial (E_F P_F) = (Q_F^{min} - \hat{Q}_F)/(E_F P_F - P_D) < 0 \qquad (9)$$

and

$$\partial \hat{Q}_F / dP_D = \hat{Q}_F/(E_F P_F - P_D) > 0. \qquad (10)$$

Method I then implies the following own-price and cross-price effects of price changes. Because of the arbitrage opportunity, a change in P_F will have smaller substitution and income effects than otherwise. Thus, except for the initiatory calls necessary to effect the arbitrage, F's total telephone activity (including transfers to D) will be hardly influenced by a change in P_F. As a consequence, the number of calls originating from F would hardly respond at all to a change in P_F or P_D as long as $E_F P_F > P_D$. F would continue to make shorter calls herself and transfer long calls to D. Each long call would be preceded by a very short call from F to D. Thus, the average duration of calls from F to D would be a declining function of P_F and an increasing function of P_D. At the same time D would pay for more calls as P_F increases and as P_D declines. The average duration of calls transferred to D decreases in P_F and increases in P_D.

The effect on the duration of all calls made by D is somewhat ambiguous. The reason is that this mixes in with the length distribution of calls originating from D. The most likely overall effect is that an increase in P_F will first increase the average length of call paid for by D. This is because the marginal call transferred from F is longer than the average call made by D. After some critical value of P_F, further increases of P_F will decrease the average length of call paid for by D because the marginal call transferred by F becomes shorter. An increase in P_D is likely to decrease the average length of call originating from D. This mixes in with an increase in the average length of call transferred from F. At values of P_D very close to $E_F P_F$ and very far from $E_F P_F$, the first effect is certainly going to dominate, while at values of P_D closer to the middle of that range the second effect may be stronger. In this case, as P_D increases, the average length of call first decreases, then increases, and then decreases again.

Under Method II the transaction cost per call would be

$$T^{II} = Q^{min} P_D + \underline{c}$$

Here Q^{min} is the extension of call time necessary to set a date for the next call. If $Q^{min} = Q_F^{min}$, this method would be cheaper than Method I. Again there is a critical length of call for F at which point she would transfer all longer calls to D. This length is

$$\hat{Q}_F = (Q^{min}P_D + \underline{c})/(E_FP_F - P_D) \quad . \tag{11}$$

The two relevant first derivatives are

$$\partial\hat{Q}_F/\partial P_F = -\hat{Q}_F/(E_FP_F - P_D) < 0 \tag{12}$$

and

$$\partial\hat{Q}_F/dP_D = (\hat{Q}_F - Q^{min})/(E_FP_F - P_D) > 0 \quad . \tag{13}$$

Under Method II, F would make substantially fewer calls to D. F would continue to make the short calls for which the cost of arbitrage exceeds the cost difference between F and D. Thus, both number and duration of calls paid by F would decrease in P_F and increase in P_D. The change in average length of call from F to D would be smaller than under Method I. The implications for D are quite similar to those in Method I with respect to number and average duration of calls, although Q^{min} is now added to the length of all calls transferred to D from F.

Figures 1 through 4 show that rate differences between calls originating and calls terminating in the United States for each of the specified countries except the United Kingdom have decreased considerably from 1979 to 1986. Hence incentives for arbitrage should have gone down. However, the available data show that our prediction for the average length of calls holds only for West Germany and France but not for Italy and the Netherlands.

For $P_D > E_FP_F$ all conclusions drawn for Methods I and II would stay the same with the roles of D and F exchanged. At $P_D = E_FP_F$ there would not necessarily be a discontinuity since the probability of very long calls is going to be very small.

There is a third method of arbitrage, and that is through implicit contract, in particular between business partners. Assume that $P_D < P_F$ and that D wants to sell and F wants to buy widgets that are traded over the telephone. D can initiate all or most of the calls provided F pays a higher price for the widgets. F, who is reselling the widgets, would still be better off than a competitor who makes his own purchasing calls. The effect of this kind of arbitrage on number and average duration of calls is going to be similar to that with Method II: It will reduce the number and truncate the length of calls from F to D.

JOINT UTILITY MAXIMIZATION

We have so far assumed that the two consumers maximize utility independently. In doing so they usually fare worse in the presence of the call externality (and arbitrage opportunities) than they could have. Now assume that they successfully try to maximize their joint utility (aggregate consumer surplus) subject to the joint budget constraint:

$$\max L_{D+F} = U_D(X_D, Q_D, Q_F) + U_F(X_F, Q_F, Q_D) \tag{14}$$

$$+ \mu_{D+F}[Y_D - X_D - P_D Q_D + E_F(Y_F - X_F - P_F Q_F)] .$$

First-order conditions are:

$$\frac{\partial L_{D+F}}{\partial Q_D} = \frac{\partial U_D}{\partial Q_D} + \frac{\partial U_F}{\partial Q_D} - \mu_{D+F} P_D \leq 0 \tag{15}$$

$$\frac{\partial L_{D+F}}{\partial Q_F} = \frac{\partial U_D}{\partial Q_F} + \frac{\partial U_F}{\partial Q_F} - \mu_{D+F} P_F \leq 0 \tag{16}$$

$$\frac{\partial L_{D+F}}{\partial \mu_{D+F}} = Y_D - X_D - P_D Q_D + E_D(Y_F - X_F - P_F Q_F) \leq 0 . \tag{17}$$

The optimum described by Eqs. (15) through (17) will usually differ from the result under independent maximization. In particular, conditions (15) and (16) clearly demonstrate the public-goods character of incoming calls. The question therefore arises of how the joint maximum can be reached.

Assuming that $P_D = E_F P_F$ and that D and F know each other's utility function, the two consumers could agree on a cost-sharing rule for outgoing calls made by either of them. The rule would share the price of each call in proportion to the marginal utility derived by each participant. D would maximize

$$L_D = U_D(X_D, Q_D, Q_F) + \mu_D[Y_D - X_D - \alpha P_D Q_D \tag{18}$$

$$- (1 - \beta) E_F P_F Q_F] + \gamma_D(Q^*_F - Q_F) .$$

Here α and β are the sharing factors with $\alpha/(1 - \alpha) = (\partial U_D/\partial Q_D)/\partial U_F/\partial Q_D)$ and $\beta/(1 - \beta) = (\partial U_F/\partial Q_F)/(\partial U_D/\partial Q_F)$. Assume that these ratios are constant. Then the first-order condition to Eq. (18) with respect to Q_D yields Eq. (15). F would maximize in a similar way, yielding first-order condition (17). Clearly, the assumptions needed for this simple sharing rule to lead to an optimum are quite stringent.

However, setting $\alpha = \beta = 1/2$ may approximate the optimum fairly well. There is still the problem that one party may have to make net payments to the other, for example, because of differences between P_D and $E_F P_F$. Such net payments are unlikely to be made without some formal agreement on cost sharing. The transaction costs per pair of consumers could then be fairly high compared with the gain.

An alternative is related to the Larson, Lehman, and Weisman notion of reciprocity and best described by an example in a multiperiod framework. Assume that the willingness to pay for telephone calls between D and F, who are in regular contact, rises with the time since the last (incoming or outgoing) call. Then we can use the following self-policing device: In period one, D makes a call to F with the understanding that F will call D once the sum of D's and F's marginal utility from the call exceeds its price (rather than wait until F's marginal utility alone exceeds the price of the call), and vice versa for the following call. If F does not call at the agreed-upon time, then D will forever go back to independent calling at time intervals when D's own marginal utility from calling F exceeds the price. This can be seen as a supergame. Each player will play the repeated "cooperative" strategy as long as the discounted payoff exceeds the one-time gain from "cheating" plus the discounted payoff from independent maximization (single-period Nash) ever after.

Consider a numerical example for this phenomenon: Assume that in each period the individual willingness to pay is \$1.90 if the last telephone conversation was made during the last period and \$2.10 otherwise. The telephone tariff is \$2.00 in both directions. The payoff matrix for period one is:

	F call	No call
D call	.9/.9	−.1/1.9
No call	1.9/−.1	0/0

The top-left cell contains an expected payoff: If both want to call in the same period, there is a 50 percent chance that the other party will get through first.

In the second period we get the same payoff matrix for all period one outcomes in which a call was made. However, for the no-call situation in period one, we get the following payoff matrix for period two:

	F call	No call
D call	1.1/1.1	.1/2.1
No call	2.1/.1	0/0

Other payoff matrices are irrelevant for our example. Now assume that the two players play Nash every period. Then in the first period they will not call, in the second period they will both try to call, in the third period they will not call, in the fourth period they will both try to call, and so on. Assuming an infinite time horizon, we get a discounted stream of $V_D = V_F = 1.1(1 + r)/(2r + r^2)$, where r is the interest rate. Now if they "cooperate," they will each have a discounted surplus stream of $V_D = V_F = .9/r$. Collusion pays better than playing Nash all the time if r is less than 350 percent. Now assume that under collusion, D calls in period one but F cheats and does not call back in period two. Then by assumption both will play Nash from period three to infinity. The discounted payoff for D will then be $V_D = 1.1/(1 + r)(2r + r^2) - .1/(1 + r)$, which is smaller than playing Nash from the start. The payoff for the "cheater" F is $V_F = 1.1/(1 + r)(2r + r^2) + 1.9/(1 + r)$. It turns out that cheating only pays for F if the interest rate is above 72 percent.

Now, what is the likely effect of joint maximization on elasticities? Let us again use log linear demand equations of the form (6) and (7) and assume that joint maximization is achieved by independently calling and sharing the other's costs as done in Eq. (18). Then Eqs. (6) and (7) become:

$$\log Q_D = a_D + b_D(\log \alpha + \log P_D) + c_D \log Q_F \qquad (19)$$

$$+ d_D(\log (1 - \beta) P_F Q_F + \log Y_D)$$

$$\log Q_F = a_F + b_F(\log \beta + \log P_F) + c_F \log Q_D \qquad (20)$$

$$+ d_F(\log (1 - \alpha) P_D Q_D + \log Y_F) \quad .$$

It is clear that at zero-income elasticities ($d_D = d_F = 0$), joint maximization would have no effect on own- and cross-price elasticities of demand. Only the *level* of demand would be affected by joint maxi-

mization. However, with nonzero-income elasticities we get the following price elasticities:

$$\epsilon_{DD} = \frac{b_D + (c_D + d_D)\, d_F}{1 - (c_F + d_F)(c_D + d_D)} \quad , \quad \epsilon_{FF} = \frac{b_F + (c_F + d_F)\, d_D}{1 - (c_F + d_F)(c_D + d_D)} \quad ,$$

$$\epsilon_{DF} = \frac{d_D + (c_D + d_D)\, b_F}{1 - (c_F + d_F)(c_D + d_D)} \quad , \quad \epsilon_{FD} = \frac{d_F + (c_F + d_F)\, b_D}{1 - (c_F + d_F)(c_D + d_D)} \quad .$$

We cannot restrict the size and sign of the income-related terms d_D and d_F. Therefore, these elasticities can differ almost arbitrarily from those under independent maximization in both sign and magnitude.

Certainly, if P_D is unequal to $E_F P_F$, then arbitrage also becomes important for joint maximization. This arbitrage may involve transaction costs similar to those incurred commercially and described by Methods I and II above. However, the fixed cost c may be smaller or missing. The basic conclusions therefore should carry over. One of these conclusions is that the cross elasticities under arbitrage are sensitive to the exchange rate, while the cross elasticities under independent maximization without arbitrage are sensitive to the domestic purchasing power of each currency.

INTERACTION OF EXTERNALITY AND ARBITRAGE

International telephone-demand elasticities are likely to be simultaneously influenced by call externalities and opportunities for arbitrage. The externality (or reciprocal calling) effect will depend on the quantity of calling by the other party, while the arbitrage effect will depend on the price difference between the two countries. Larson and Lehman (1986) describe the arbitrage effect with transaction costs in a much simpler way than do the stylized Methods I and II described above. Larson and Lehman do not differentiate by call length. Then $| P_D - P_F | > T$ implies that arbitrage is possible. Larson and Lehman assume that the fraction of arbitraged calls is a logistic function of $(P_D - P_F)$.

While the logistic function certainly has merits in this case, we believe that it can be linearized for most of its range. For practical reasons we also prefer to use the price ratio rather than the price difference to describe the arbitrage effect. In particular, in log linear demand equations, the price ratio can be expressed as the logarithmic difference between the two prices. Thus, we do not have to add an extra variable. Equations (6) and (7) now become:

$$\log Q_D = a_D + b_D \log P_D + c_D \log Q_F + d_D \log Y_D \qquad (21)$$

$$+ e_D(\log P_D - \log P_F)$$

$$\log Q_F = a_F + b_F \log P_F + c_D \log Q_D + d_F \log Y_F \qquad (22)$$

$$+ e_F(\log P_F - \log P_D) \quad .$$

Solving for the elasticities we get:

$$e_{DD} = \frac{b_D + e_D - c_D e_F}{1 - c_D c_F} \quad , \quad e_{FF} = \frac{b_F + e_F - c_F e_D}{1 - c_D c_F} \quad ,$$

$$e_{DF} = \frac{(b_F + e_F)c_D - e_D}{1 - c_D c_F} \quad , \quad e_{FD} = \frac{(b_D + e_D)c_F - e_F}{1 - c_D c_F} \quad .$$

Assuming that $| c_D | < 1, | c_F | < 1$, and that arbitrage effects are symmetric and negative ($e_D \simeq e_F < 0$), we find that arbitrage will make own-price elasticity of demand more elastic. At the same time arbitrage will make otherwise negative cross elasticities less elastic or even positive and make positive cross elasticities more elastic.

We now want to include the possible effects of inflation and exchange rates. Equations (21) and (22) will have to include exchange rates E_F to account for the fact that arbitrage opportunities depend on financial gains. They will have to include the foreign price at purchasing-power parity P_P to express real prices in the country's currency. And they will have to include GDP (gross domestic product) deflators D_D and D_F to account for inflation. Then Eqs. (21) and (22) become:

$$\log Q_D = a_D + b_D \log P_D D_D + c_D \log Q_F + d_D \log Y_D D_D \qquad (23)$$

$$+ e_D(\log P_D D_D - \log E_F P_F)$$

$$\log Q_F = a_F + b_F \log P_F P_P D_F + c_F \log Q_D + d_F \log Y_F D_F \qquad (24)$$

$$+ e_F(\log E_F P_F D_F - \log P_D) \quad .$$

It is clear now that we could use D_D, D_F, E_D, E_F, and P_P as separate variables along with nominal prices. For example, Eq. (23) would then become:

$$\log Q_D = \frac{1}{1 - c_D c_F} [a_D + c_D a_F + (b_D + e_D - c_D e_F) \log P_D \quad (25)$$

$$+ (b_D + d_D + e_D) \log D_D + (c_D b_F + c_D e_F - e_D) \log P_F$$

$$+ (e_D e_F - e_D) \log E_F + (c_D (b_F + d_F + e_F)) \log D_F$$

$$+ c_D b_F \log P_P + d_D \log Y_D + c_D d_F \log Y_F] \quad .$$

This equation indicates some clear restrictions on the relative size of coefficients for deflators, exchange rates, and the purchasing-power parity that could be used for empirical testing.

To sum, in terms of own-price elasticities we expect that arbitrage alone should result in positive cross elasticities. Combining arbitrage and interdependent utility may give us positive cross elasticities due to both positive arbitrage effects and positive interdependence effects or due to stronger positive arbitrage effects than negative interdependence effects. Negative cross elasticities could occur only as the result of strong negative interdependence effects that outweigh the positive arbitrage effects.

POLICY CONSEQUENCES

In this section we have characterized different configurations for international telephone demand, each for a pair of telephone consumers. We consider all of these configurations to be realistic and to occur side by side. For policy considerations and empirical estimation it therefore matters how the different effects sum up in the aggregate. We expect arbitrage to play a major role in determining the length of calls. Since arbitrage opportunities depend on financial gains, their effects could be tested by looking at cross elasticities with prices converted at current exchange rates. Interdependence effects of call externalities depend on the quantity of incoming calls; this quantity in turn depends on the real price in the country of the caller. These interdependence effects could therefore best be measured by looking at cross elasticities with prices expressed in local deflated currencies.

OTHER SERVICES

Other telecommunications services such as telex and telegraph may be either substitutes or complements to voice calls. In some circumstances they may represent an obvious substitute: Consider, for example, placing a hotel reservation abroad, especially if the time difference is substantial or if the other party may not speak the caller's language. In other circumstances, the telex may represent a complementary good: For example, a common business practice is to request that an order for manufactured goods be confirmed by telex after an agreement is reached by telephone.

IV. MODELING, ESTIMATION, AND DATA CONSIDERATIONS

MODELING

We are estimating demand for telephone calls across the North Atlantic market. It is reasonable to ask if supply is exogenously determined, or if our estimates reflect a simultaneous determination of supply and demand.[1] In the present case, we believe that supply can legitimately be considered exogenously determined. Prices for international calls are set in advance of the call being placed, and they remain in effect for a period of time—typically a year or longer. During that period, supply is rarely constrained; for practical purposes, the consumer faces an infinite supply of international calling capacity at the posted price. (It is possible in principle that local access to international capacity will be congested and that international calls will not be completed; with the exception of major holidays, we suspect that this is relatively uncommon for the bulk of traffic across the North Atlantic, although it may be more significant for calls placed to and from less-developed countries.) Earlier studies of demand may include data from the early 1970s when some capacity constraints existed in international supply. By the late 1970s, aggregate capacity of cable and satellite exceeded the annual maximum traffic demand by a substantial factor, and it now exceeds demand by a factor of two (see Johnson, 1986).

The other possible source of simultaneity between demand and supply is introduced by the declining block pricing structure faced by U.S. customers and those in some other countries. Under those structures, some of the observed variation in quantity will be correlated negatively with price.[2] We feel that this problem is not significant in our case for two reasons. First, for our analysis we use the marginal price faced by customers who consume in the tail block of the rate structure. This means that there is no artificial negative correlation between quantity and the average price (which necessarily falls as quantity increases under a declining block structure). Second, empirically, the average length of calls is over eight minutes, which is substantially beyond the

[1]Working (1927) introduced the concern that simultaneous movements of supply and demand curves may present the empiricist with price-quantity combinations that do not uniquely reflect either supply or demand.

[2]See Acton, Mitchell, and Sohlberg (1980) or Halvorsen (1978) for discussions of demand modeling in the face of declining block pricing structures for electricity.

one- or three-minute period for inframarginal blocks of the rate structure. Consequently, the marginal price faced in the "average" call is that of the tail block.

When a declining block pricing structure applies (including two-part rates broken into an "entry" charge and a single marginal price per unit consumed), the extra costs associated with the inframarginal block of the rate structure should act as an income effect to the customer.[3] That is, if MP1 represents the marginal price in the first block and MP2 represents the marginal price in the second block, then consumers whose consumption takes them to the second block pay an "entry" charge equal to MP1 minus MP2 times the number of minutes to which the first block applies.

CHOOSING SHARE OR QUANTITY AS THE DEPENDENT VARIABLE

Above, we developed predictions for the share of outbound calls as well as predictions for the quantity of calls inbound and outbound. There is no theoretical reason to prefer one dependent variable over the other; the choice probably depends on (1) the policy questions one considers most important and on (2) one's view of the world.

Policy Considerations

If the analyst is most concerned with the distribution of effects between inbound calls and outbound calls and the manner in which pricing policies may affect that balance, then share equations are satisfactory. If, on the other hand, the analyst is primarily interested in the magnitude of the effects, and not just their distribution, then quantity is the preferred dependent variable. Quantity equations permit direct predictions of such effects as those on welfare and on balance of payments, which are important for the evaluation of many policy alternatives. In areas of policy, we prefer quantity as the dependent variable.

Views of the World

The alternative views of the world that may influence one's choice of dependent variable can be summarized as follows. (a) Volume of calls is determined by factors other than price; relative prices between inbound and outbound calls only influence the balance between inbound and outbound traffic. This view favors share equations. (b)

[3]See Taylor (1975), Halvorsen (1978), or Acton, Mitchell, and Sohlberg (1980).

Prices have an effect on (i) the quantity of calls, (ii) the choice of calls versus other forms of communication, and (iii) the direction of calling (inbound or outbound). This view favors equations with quantity as the dependent variable.

We favor a specification with quantity as the dependent variable both for policy reasons and because we think it captures more realistically the dimensions of calling; consequently, most of our discussion focuses on quantity regressions. However, we summarize the effects of share equations as well in the discussion below.

THE DATA

We examine telephone traffic between the United States and 17 West European countries over the period 1979–1986. Our consumption data are taken from the annual reports of international telecommunications use of the Federal Communications Commission (FCC). This information presents total number of calls and minutes for traffic between the United States and foreign countries.[4] We use minutes of calling as the dependent variable. The data are available in greater aggregation than we would prefer: They are annual, they include all customer groups, and they are not distinguished by the rating period during which the call was placed. In future work it would be desirable to disaggregate along each of these dimensions.

The price variable used in our analysis is the marginal price faced by customers in the tail block of the standard daytime rate schedule; this marginal price applies to the majority of calls that take place. It is deflated by the GDP deflator for each country and then converted to U.S. dollars using the exchange rate.[5]

Other explanatory variables try to capture the major factors that may determine volume of calling between countries or the balance of inbound and outbound traffic. Given the relatively limited number of observations, we have selected a small set of variables. The volume of trade between the United States and each of the 17 countries is entered as an explanatory variable.[6] This is deflated by the U.S. GDP deflator. To account for possible differences among countries in the composition of trade-related communication with the United States, we enter a second explanatory variable that indicates the share of employment in

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[4]See Federal Communications Commission, various years. It also reports telegraph and telex use, but we confine our attention to international measured voice traffic.

[5]International Monetary Fund, *International Financial Statistics*.

[6]International Monetary Fund, *Direction of Trade Statistics, Yearbook 1987*.

each country in five major economic activities.[7] We expect, for example, that countries with a higher fraction of their labor force in manufacturing may be more likely to have trade-related communications with the United States than do countries with a higher fraction of their employment in, say, transportation.

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[7]The activities are (1) agriculture, (2) restaurants and hotels, (3) transportation, (4) banking and financial, and (5) manufacturing.

V. EMPIRICAL RESULTS

We estimate the demand for international telephone calls using pooled time-series cross-sectional data. Given the aggregated nature of the annual data, the limited number of observations, and the general—rather than specific—guidance provided by economic theory in this case, we approach the estimation in the spirit of exploratory data analysis rather than in the spirit of rigorous testing of a theoretically derived set of hypotheses. We focus our attention on the effects of call prices, telex prices, and some economic and demographic information. The primary emphasis is on quantity of minutes as the dependent variable, although we also provide a comparison with share of calls originating in the United States as the dependent variable.

There are a number of considerations in this exploratory analysis, including whether to weight the observations, whether to correct for autocorrelation in the data, whether to separate price effects by time, and whether to include country-specific dummy variables. The results are based on regression where the variables are weighted by the share of U.S. telephone traffic going to the country involved. This may help deal with heteroscedasticity in the data, and it means that the coefficients should be interpreted as the effects (caused by changing a variable applied to all countries) on total minutes called.[1] We could not reject the hypothesis of no autocorrelation in the error term, and therefore made a first-order autocorrelation correction in the data.[2] Finally, we included country-specific dummy variables because an examination of the residuals indicated that when those variables are omitted the mean residual by country is not zero.

PRINCIPAL EFFECTS IN THE QUANTITY REGRESSIONS

The general form of the equations is as follows:

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[1]In our preliminary analysis, we also estimated each specification using unweighted regressions. In fact, once outliers were excluded, most coefficients were little changed between weighted and nonweighted regressions in the core specifications, and the level of statistical significance sometimes improved with weighting.

[2]The price estimates did not actually appear to be very sensitive to these corrections, but econometric theory leads us to prefer models with correction for autocorrelation because otherwise the estimates of statistical significance will be biased.

$$\ln Q = a + \Sigma\, b_j \ln P_j + c \ln \text{Trade} + d \ln \text{Num Telephones} + \Sigma\, e_i \text{Sector}_i + \Sigma\, f_i \text{Country}_i \quad (26)$$

where Q indicates minutes of calls from (to) the United States to (from) each of the 17 West European countries, P_j indicates the price of four telecommunications services (for the marginal price of telephone calls originating and terminating in the United States and the average price of a telex minute originating and terminating in the United States), *Trade* is the sum of exports and imports between the United States and each country (in real terms, converted to U.S. dollars), *Num Telephones* is the number of telephones in the European country, $Sector_i$ indicates the fraction of the labor force employed in each of five major economic sectors in the European country, and $Country_i$ is a dummy variable for each of the 17 countries (the omitted country variable is the United Kingdom).

Price Effects

Prices are all stated in real terms, using the country's GDP deflator. However, we still have a choice between converting prices to U.S. dollars or leaving them in the country's currency. We base our principal discussion on prices expressed in U.S. dollars. However, we also report the effect of leaving prices in the country's currency. Likewise, our initial focus is on a single marginal price for the marginal minute of calling. Later we report the effect of including the inframarginal charges in a specification using average price instead.

Table 3 reports the estimated price coefficients for outbound and inbound telephone traffic between the United States and the 17 countries. The first four sets of coefficients report the effect of marginal price. We saw some evidence of differences between price response in our exploratory analysis of earlier and later years and between report coefficients for two subperiods.[3] Since they were estimated in a double-logarithmic specification, these coefficients are the price elasticities of demand in this specification. The own-price elasticity gives the percentage change in minutes of calling *from* the United States as a function of the percentage change in price of calls *originating* in the United States (and works similarly for calls *terminating* in the United States and price of calls *to* the United States). The cross-price elasticity gives the percentage change in minutes of calling for calls *from* the United States as a function of the percentage change in price of calls *to*

[3]After empirically discovering this apparent shift in demand, we also learned that international direct distance dialing was generally made available in the early 1960s—providing a possible explanation for the shift.

Table 3

ESTIMATED COEFFICIENTS WHEN MARGINAL PRICE IS USED AS AN EXPLANATORY VARIABLE

Category	Originating in the U.S.	Terminating in the U.S.
Marginal price effects (ln)		
Telephone price from U.S.		
1979–1982	−0.14	0.41
	(−1.00)	(1.33)
1983–1986	−0.98	−0.62
	(−8.75)	(−2.54)
Telephone price to U.S.		
1979–1982	−0.10	−0.51
	(−2.28)	(−5.19)
1983–1986	−0.07	−0.31
	(−1.78)	(−3.82)
Telex price from U.S.	−0.82	−0.51
	(−6.06)	(−1.60)
Telex price to U.S.	0.43	−0.25
	(4.06)	(−1.02)
Other variable effects		
ln International trade volume	−0.16	0.26
	(−1.74)	(1.39)
ln Number of European telephones	1.76	0.77
	(14.37)	(2.78)
Size of economic sector		
Agriculture	1.04	0.85
	(4.51)	(1.86)
Restaurants and hotels	1.56	3.37
	(3.20)	(3.32)
Transportation	−0.74	0.75
	(−2.33)	(1.10)
Banking and financial	0.35	1.01
	(1.90)	(2.34)
Manufacturing	0.37	2.90
	(0.95)	(3.29)
Intercept	0.11	−0.15
	(1.68)	(−1.03)
R^2	0.999	0.999

NOTES: Values of country-specific dummy variables and autocorrelation correction are reported in the appendix. T ratio is in parentheses.

the United States (and works similarly for calls *terminating* in the United States and price of calls *from* the United States).

Generally, own-price coefficients are statistically different from zero, while cross-price coefficients are negative and not all statistically different from zero. When significantly different from zero, demand is generally more price elastic for calls originating in the United States, and it is inelastic for calls terminating in the United States. As we discussed in Sec. III, a statistically significant, negative cross-price elasticity is consistent with the "externalities" interpretation of complementarity in calling. It is not consistent with an arbitrage motivation as the dominant effect. Coefficients that are not statistically different from zero could be consistent with either motivation. On balance, the cross-price effects seem most consistent with the externalities interpretation.

The own-price elasticity for calls originating in the United States is statistically insignificant in the earlier period (1979 to 1982) and highly significant in the second period at approximately −1.0. The value −1.0 is large for most economic goods, but it lies within the range of values reported by some earlier reseachers.[4] The statistically insignificant result in the earlier period may reflect the relatively greater importance of the block pricing structure before 1982—where the initial rating period was longer and notably greater than the second block. The results discussed in the next subsection explore a richer price specification. The insignificance may also reflect data aggregation across rating periods; further disaggregation into periods and into classes of customers would help determine more precisely the effects of the prices.

The effect of U.S. telex charges is negative and significant for telephone minutes from the United States. The effect of foreign telex charges is statistically insignificant for inbound telephone traffic. The complementary nature of telex to telephone calls for calls originating in the United States is consistent with the business practice of requesting a confirmation or elaboration of telephone conversations.[5]

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[4]Taylor (1980), p. 149, reports a price elasticity of −0.38 for minutes from the United States to the United Kingdom, and a short-run elasticity of messages with respect to price ranging between −0.23 and −0.89. He reports long-run elasticities of messages between −0.52 and −3.65. Tests of statistical significance are not reported. Many such studies are based on Canadian data. However, Rea and Lago (1978) report own-price elasticities of −1.78 using data from 1969 to 1973, and Lago (1970) reports elasticities ranging from −1.249 to −1.689 using data from 1962 to 1963.

[5]Two earlier studies include telex prices in an international telephone demand equation; one, Rea and Lago (1978), reports a positive effect of 0.78; the other, Yatrakis (1972), reports negative values between −0.42 and −0.49.

Other Variables

Table 3 also shows the effects of the other economic and demographic variables entered into the principal specification. Volume of international trade with the United States has a statistically insignificant effect on telephone calls. The number of telephones is statistically very significant and provides a more than proportional increase in volume. International calling is increased with increases in the economic sectors of agriculture, restaurants and hotels, banking and financial, and manufacturing. It is decreased by a greater fraction of the employment involved in transportation for calls originating in the United States.

In earlier analysis, we examined the effect of the level of economic activity (GDP) and population size in a specification that did not include the number of telephones. Both variables had positive, generally significant effects on minutes of calling. However, when the number of telephones was included as an explanatory variable, the coefficients on GDP and population became erratic and almost always statistically insignificant. We selected the specifications reported here because of the stability in the coefficients, and we offer the interpretation that income is acting through the number of telephones to influence the level of calling.

We do not report the values of the country-specific dummy variables in this table, but the results are available in the appendix. Recall that the omitted country variable is for the United Kingdom. Relative to that value, 11 of the 16 variables are different at a statistically significant level—with eight of these values being positive.[6]

EFFECTS OF THE INFRAMARGINAL CHARGE

Under a declining block pricing structure, the added payment above the tail-block marginal price—multiplied by the number of minutes in the block—acts as an entry charge for consumption in the tail block. This entry charge should have an effect on consumption similar to the income effect—although opposite in sign. Given the relatively small share that telecommunications constitutes in most budgets, this effect should be small for consumers who regularly make international telephone calls, although it may be more important for those considering whether to call at all.

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[6]Belgium, Greece, Ireland, Luxembourg, the Netherlands, Norway, Portugal, and Switzerland have statistically significant positive coefficients in this specification. France, Italy, and Spain have statistically significant negative coefficients.

Table 4 shows the effect of a quantity specification in which both the marginal price and the inframarginal charge in the U.S. rates are entered as explanatory variables.[7] This specification sheds some light on the own-price coefficient reported in Table 3. In the first time period (1979 to 1982), the step between the first and second blocks of the rate structure is larger than in later years, and it applies to three minutes rather than one minute. In Table 4, the coefficient of the marginal price for calls originating in the United States is statistically insignificant, but the inframarginal price coefficient is statistically significant and negative. This is consistent with the interpretation that the overall price of the call affects demand and that the inframarginal charge is an important component.

In the second period of time, both the inframarginal and marginal price components are statistically significant, with the inframarginal component having the wrong (positive) sign. However, elasticity with respect to the marginal component is larger in magnitude and very similar to the value reported in Table 3 for the marginal-price-only specification. The remaining coefficients in this equation are very similar to those in Table 3, with the exception of the telex price to the United States and the trade variable—both of which become statistically insignificant.[8] These findings are still consistent with an externalities interpretation of the price effects of telephone rates, as well as the complementary relationship between telephone and telex usage for calls originating in the United States. Introducing these two components of the U.S. telephone tariff has little effect on the coefficients in the equations describing calls terminating in the United States.

EFFECTS OF USING AVERAGE PRICE

It is theoretically correct to use elements of the rate schedule—the marginal price, inframarginal charges, and so forth—when estimating demand by individuals or groups of individuals facing identical pricing schedules. In the present circumstances, however, the annual data include business and residential users facing peak, shoulder, and off-peak rates when calling from the United States, and foreign callers sometimes facing multiple schedules. As a result, some of the calls are billed at lower rates than the marginal price of peak-period calls used

[7]We do not enter such variables for calls terminating in the United States because most European schedules charge identical amounts per period of time without a declining price feature.

[8]The coefficients on the country-specific dummy variables are virtually identical, although West Germany becomes negative and significant and the Netherlands becomes statistically insignificantly different from zero.

Table 4

ESTIMATED COEFFICIENTS WHEN INFRAMARGINAL PRICE IS USED AS AN EXPLANATORY VARIABLE

Category	Originating in the U.S.	Terminating in the U.S.
Marginal and inframarginal price effects		
Marginal telephone price from U.S.		
1979–1982	0.02	0.47
	(0.12)	(1.03)
1983–1986	−0.91	−0.65
	(−7.97)	(−2.37)
Inframarginal telephone price from U.S.		
1979–1982	−0.09	−0.01
	(−2.41)	(−0.11)
1983–1986	0.21	0.09
	(4.54)	(0.82)
Telephone price to U.S.		
1979–1982	0.06	−0.44
	(1.41)	(−3.37)
1983–1986	−0.01	−0.27
	(−0.15)	(−2.68)
Telex price from U.S.	−0.56	−0.47
	(−3.78)	(−1.32)
Telex price to U.S.	−0.26	−0.42
	(−1.09)	(−0.76)
Other variable effects		
ln International trade volume	0.06	0.29
	(0.90)	(1.48)
ln Number of European telephones	1.53	0.67
	(12.27)	(2.29)
Size of economic sector		
Agriculture	0.63	0.83
	(2.54)	(1.58)
Restaurants and hotels	0.97	3.45
	(2.01)	(3.24)
Transportation	−0.37	1.04
	(−1.16)	(1.43)
Banking and financial	0.41	1.00
	(2.28)	(2.23)
Manufacturing	1.03	3.07
	(2.55)	(3.18)
Intercept	0.06	−0.07
	(0.85)	(−0.47)
R^2	0.999	0.999

NOTES: Includes country-specific dummy variables. T ratio is in parentheses.

in the previous analysis, and some callers pay more when paying rates for operator-assisted calls. In principle, we may wish to consider average price as a better overall representation of these different prices. We can calculate the average price paid by all calls taken together by dividing the annual billing by the number of minutes billed.[9] Table 5 presents the results of this analysis.

In general, the price coefficients have a similar, or slightly improved, pattern of statistical significance. In addition, where the corresponding coefficients are statistically significant in both specifications, elasticity values are very similar. The price effect on own-price elasticity for calls originating in the United States—the coefficient that was most perplexing in Table 3—is closer to being statistically significantly different from zero at conventional levels of significance, and it is of the expected negative sign. The remaining effects—with respect to telex charges, numbers of telephones, and the like—are very similar to those in the preceding tables. These findings are still consistent with the externalities motivation for calling discussed in Sec. III but not with the arbitrage interpretation. Telex price effects are essentially unchanged when the average telephone price is used.

EFFECTS OF STATING PRICES IN EACH COUNTRY'S CURRENCY

The results just discussed are based on specifications in which the prices are converted to U.S. dollars (after deflating them by the country's GDP deflator). This specification seems especially appropriate when arbitrage is important, but it causes the prices to fluctuate with changes in the exchange rate. If instead, the party placing the call is primarily concerned with the effect on his own bill—that is, the call is either a private good or a good not motivated by arbitrage concerns—then the price should be stated in the currency of the caller.[10]

In Table 6, we report the results of such analysis. Telephone prices are deflated by the country's GDP deflator. To make the currency units comparable to one another, and comparable to the previously

[9]In the FCC traffic data, this variable consists of "Revenue" (retained by the U.S. carrier) plus "Payouts" (the amount paid to foreign carriers under the settlements agreements, divided by the number of minutes). This average is an approximation because it does not include state and federal taxes paid by customers. Furthermore, the amount of total billing to foreign customers is based on estimates provided by ATT in its annual filing with the FCC, Report 41.63, Schedule MT. We are indebted to Ken Stanley of the FCC for assistance in obtaining this information.

[10]Stating the price this way may also be more appropriate when the party is concerned with the externalities generated by the quantity of calls.

Table 5

ESTIMATED COEFFICIENTS WHEN AVERAGE PRICE IS USED AS AN EXPLANATORY VARIABLE

Category	Originating in the U.S.	Terminating in the U.S.
Average price effects		
ln Average telephone price from U.S.		
1979–1982	−0.15	0.02
	(−1.64)	(0.11)
1983–1986	−0.86	−0.53
	(−10.16)	(−2.47)
ln Average telephone price to U.S.		
1979–1982	−0.19	−0.45
	(−3.13)	(−3.04)
1983–1986	−0.09	−0.26
	(−1.82)	(−2.21)
ln Telex price from U.S.	−0.58	0.09
	(−4.80)	(0.27)
ln Telex price to U.S.	0.31	−0.35
	(3.41)	(−1.57)
Other variable effects		
ln International trade volume	−0.09	0.49
	(−1.22)	(2.43)
ln Number of European telephones	1.61	0.91
	(14.90)	(3.45)
Size of economic sector		
Agriculture	1.05	0.61
	(4.61)	(1.21)
Restaurants and hotels	1.91	2.40
	(4.36)	(2.44)
Transportation	−0.11	0.19
	(−0.38)	(0.27)
Banking and financial	0.40	0.79
	(2.41)	(1.93)
Manufacturing	0.26	0.73
	(0.76)	(0.82)
Intercept	0.02	−0.12
	(0.60)	(−0.01)
R^2	0.999	0.999

NOTES: Includes country-specific dummy variables. T ratio is in parentheses.

Table 6

ESTIMATED COEFFICIENTS WHEN TELEPHONE PRICES ARE STATED IN COUNTRY'S CURRENCY

Category	Originating in the U.S.	Terminating in the U.S.
Marginal price effects (ln)		
Telephone price from U.S.		
1979–1982	−0.13	0.22
	(−1.05)	(0.79)
1983–1986	−1.00	−0.35
	(−8.43)	(−1.39)
Telephone price to U.S.		
1979–1982	−0.07	−0.54
	(−1.43)	(−4.85)
1983–1986	−0.01	−0.49
	(−0.21)	(−4.99)
Telex price from U.S.	−0.73	−0.73
	(−5.29)	(−2.40)
Telex price to U.S.	0.30	−0.07
	(2.70)	(−0.27)
Other variable effects		
ln International trade volume	−0.14	−0.08
	(−1.44)	(−0.44)
ln Number of European telephones	1.77	1.15
	(13.51)	(4.18)
Size of economic sector		
Agriculture	0.92	0.40
	(3.84)	(0.85)
Restaurants and hotels	1.50	3.88
	(3.06)	(3.70)
Transportation	−0.53	0.23
	(−1.61)	(0.34)
Banking and financial	0.36	0.89
	(2.10)	(2.07)
Manufacturing	0.27	2.96
	(0.68)	(3.21)
Intercept	−0.00	−0.05
	(−0.06)	(−0.42)
R^2	0.999	0.999

NOTES: Values of country-specific dummy variables and autocorrelation correction are reported in the appendix. T ratio is in parentheses.

reported coefficients, we make a one-time conversion using the purchasing-power parity adjustment estimated by Summers and Heston (1984). We use parities estimated for the year 1979, the first year in our series for this adjustment.

Because this change in price variable affects non-U.S. callers, we expect the biggest effect on calls terminating in the United States. Own-price elasticities for calls terminating in the United States become somewhat more elastic and statistically significant when compared with the results reported in Tables 3 and 5. Own-price elasticity is nearly the same in the earlier period (−0.54, compared with −0.45 to −0.51), and it becomes more elastic from 1983 to 1986 (increasing from approximately −0.30 to −0.49 in Table 6). The cross-price effects for calls originating and terminating in the United States become statistically insignificant in Table 6, whereas the majority of these effects were significant and negative in Tables 3 and 5. Statistical insignificance of these cross-price effects is consistent with an arbitrage motivation for initiating the call.

RESULTS FROM ESTIMATING SHARE EQUATIONS

As we discussed above, we prefer specifications in which the dependent variable is quantity, because we think it better reflects reality and because it is more useful for policy analysis. In Table 7, we report estimates in which the dependent variable is the share of calls originating in the United States for each pairing of the United States with the 17 West European countries. In this analysis we test the effects of using both marginal price per minute and average revenue per minute. The remaining variables are similar in character to those previously employed, but because shares are constrained to lie between zero and one, we normalize these remaining explanatory variables so that the value in 1979 equals 1.0. Because of this rescaling, it is appropriate to compare only patterns of statistical significance with previous estimates.

The share equation using the marginal price produces more consistently statistically significant effects, although the price effects and most other coefficients have a similar pattern in the equation using average price. Concentrating on marginal price, we find that higher prices for calls from the United States reduce the share of calls originating in the United States, and higher prices in other countries increase the share originating in the United States. Telex prices continue to display a pattern consistent with the complementary nature of the service, and a greater number of telephones in a European country increases the share of calls from the United States—suggesting that the greater the number of locations to which the United States can call, the more calls it will place.

Table 7

SHARE EQUATIONS, USING EITHER MARGINAL OR AVERAGE PRICE

Category	Using Marginal Telephone Price	Using Average Telephone Price
Marginal price effects		
Telephone price from U.S.		
1979–1982	−0.21	−0.04
	(−3.01)	(−0.69)
1983–1986	−0.06	−0.07
	(−1.01)	(−1.37)
Telephone price to U.S.		
1979–1982	0.11	0.05
	(5.05)	(1.14)
1983–1986	0.06	0.03
	(3.29)	(1.20)
ln Telex price from U.S.	−0.09	−0.11
	(−1.15)	(−1.44)
ln Telex price to U.S.	0.18	0.12
	(3.20)	(2.24)
Other variable effects		
ln International trade volume	−0.03	−0.08
	(−0.91)	(−1.86)
ln Number of European telephones	0.17	0.12
	(3.70)	(2.62)
Size of economic sector		
Agriculture	0.04	−0.02
	(0.41)	(−0.16)
Restaurants and hotels	−0.32	−0.26
	(−1.44)	(−1.06)
Transportation	−0.33	−0.05
	(−2.27)	(−0.32)
Banking and financial	−0.12	−0.10
	(−1.37)	(−1.06)
Manufacturing	−0.50	−0.27
	(−2.63)	(−1.37)
Intercept	0.06	0.06
	(1.90)	(1.59)
R^2	0.979	0.960

NOTE: Includes country-specific dummy variables. T ratio is in parentheses.

VI. CONCLUSIONS

The data used in this preliminary analysis—while more highly aggregated than we would prefer—suggest some interesting implications for international telephone demand and for associated policy discussions. Below we recapitulate some of our most important findings and sketch the types of policy discussions for which they may be useful. Recall that these results are based on annual data aggregated over business and residential customers and over different rating periods; the results are subject to revision when disaggregated data can be used.

PRINCIPAL EMPIRICAL RESULTS

The specifications that use quantity of calls—measured in minutes—are more satisfactory on statistical grounds than those using share as the dependent variable.

- The demand for calls originating in the United States is almost unitarily elastic with respect to its own price in the period 1983 to 1986, and it is statistically significant. It is generally insignificantly different from zero in the period 1979 to 1982.
- The demand for calls terminating in the United States is inelastic and generally statistically significant.
- Cross-price effects are generally negative but generally not statistically significantly different from zero.

This pattern of own- and cross-price elasticities, when the cross-price elasticities are statistically significant and negative, suggests that telephone calling may contain important elements of complementarity that are consistent with a reciprocal calling motivation. When the cross-price elasticities are not statistically significant, they are consistent with a combination of reciprocal and arbitrage motivations.

The remaining explanatory variables have apparently reasonable effects.

- Telex prices are generally negative, indicating a complementary relationship with telephone calls.
- Increase in number of telephones strongly increases volume of calling, and increase in volume of trade generally increases volume of calling.

- Countries with a greater fraction of employment in sectors that may involve international coordination—agriculture, restaurants and hotels, banking and financial, and manufacturing, but not transportation—have above-average levels of calling.

POLICY RELEVANCE OF THE FINDINGS

Reliable estimates of demand for international calling can be useful in a number of policy applications. They can help to anticipate the nature of traffic growth and probable shifts as prices change. They can be used to examine the efficiency and distributional implications of a variety of pricing reforms—including alternative methods for recovering fixed costs of capital investments. They can be used to identify optimal (welfare-increasing) pricing changes that explicitly take into account the price elasticity of demand of the affected parties.

Reliable demand estimates are also useful for understanding some pricing policies that international telephone carriers have had in place for some time. For example, ATT has for several years employed off-peak discounts in its international telephone rates from the United States to European countries. The accounting settlements between ATT and the foreign carrier do not generally contain a time-of-day feature so that, at some times, the off-peak rate for calling from the United States is lower than the accounting rate that ATT pays the carrier in the country of termination. This policy, on its face, would seem irrational, since at those times each call would generate revenue at the margin that is less than the marginal (out-of-pocket) cost of the call.

However, it is possible that lowering off-peak rates, even below accounting rates, actually increases profits because of the offsetting increase in inbound calling. In the empirical estimates, we found that the price of calls originating in the United States generally has the dominant influence on volume of calls both originating and terminating in the United States. Furthermore, in the period since 1982, the effect of U.S. telephone rates on inbound calls is negative—that is, lowering the price of U.S. calls increases the volume of inbound traffic. Depending on the elasticities within these pricing subperiods and the size of the price change, these off-peak rates below accounting costs may actually increase profits to U.S. carriers and welfare to European callers.

Appendix

ADDITIONAL COEFFICIENTS

Table A.1

VALUES FOR COUNTRY-SPECIFIC DUMMY VARIABLES AND AUTOCORRELATION CORRECTIONS FOR TABLE 3

	Originating in the U.S.		Terminating in the U.S.	
Country	Dummy Variable	Autocorrelation Correction (Rho)	Dummy Variable	Autocorrelation Correction (Rho)
Austria	0.27	0.75	−1.37	0.23
	(0.83)		(−2.44)	
Belgium	1.13	0.26	−0.24	0.18
	(6.33)		(−0.63)	
Denmark	0.36	0.56	−0.67	0.59
	(1.66)		(−1.48)	
Finland	−0.26	0.74	−1.17	0.58
	(−0.73)		(−1.98)	
France	−0.91	−0.02	−0.90	0.00
	(−13.83)		(−6.28)	
Greece	1.41	−0.26	0.37	0.43
	(5.56)		(0.70)	
Ireland	3.57	0.46	0.42	−0.58
	(10.19)		(0.62)	
Italy	−0.73	0.17	−1.29	−0.35
	(−10.34)		(−9.38)	
Luxembourg	2.94	0.06	−0.13	0.65
	(6.20)		(−0.11)	
Netherlands	0.31	0.27	−0.45	−0.27
	(2.74)		(−1.96)	
Norway	1.39	0.16	0.17	0.26
	(6.52)		(0.38)	
Portugal	1.35	0.63	−1.62	0.28
	(3.90)		(−2.48)	
Spain	−0.70	−0.29	−1.26	0.27
	(−6.76)		(−5.71)	
Sweden	−0.16	0.64	−0.53	−0.15
	(−0.96)		(−2.18)	
Switzerland	1.33	−0.30	0.05	−0.01
	(8.63)		(0.14)	
United Kingdom		0.01		−0.17
West Germany	−0.05	−0.01	−0.44	−0.41
	(−0.76)		(−3.21)	

NOTE: T ratio is in parentheses.

Table A.2

VALUES FOR COUNTRY-SPECIFIC DUMMY VARIABLES AND AUTOCORRELATION CORRECTIONS FOR TABLE 6

Country	Originating in the U.S.		Terminating in the U.S.	
	Dummy Variable	Autocorrelation Correction (Rho)	Dummy Variable	Autocorrelation Correction (Rho)
Austria	0.00	0.70	−1.44	0.23
	(9.86)		(−2.58)	
Belgium	0.01	0.55	0.30	−0.02
	(23.40)		(0.76)	
Denmark	0.00	0.68	−0.78	0.56
	(14.89)		(−1.74)	
Finland	0.01	0.75	−1.31	0.65
	(28.87)		(−2.09)	
France	0.04	−0.04	−0.98	0.11
	(175.54)		(−6.71)	
Greece	0.06	0.07	0.36	0.52
	(261.19)		(0.70)	
Ireland	0.00	0.55	1.24	−0.59
	(9.03)		(1.62)	
Italy	0.00	0.32	−1.25	−0.42
	(1.37)		(−9.22)	
Luxembourg	0.00	−0.12	0.07	0.75
	(0.19)		(0.06)	
Netherlands	0.02	0.27	−0.30	−0.26
	(80.05)		(−1.31)	
Norway	0.00	0.23	0.23	0.19
	(0.58)		(0.51)	
Portugal	0.00	0.60	−1.02	0.22
	(0.01)		(−1.62)	
Spain	0.06	−0.31	−1.21	0.22
	(243.69)		(−5.65)	
Sweden	0.01	0.71	−0.56	0.38
	(33.44)		(−2.08)	
Switzerland	0.01	−0.29	0.03	0.42
	(59.83)		(0.09)	
United Kingdom		0.22		−0.10
West Germany	0.21	−0.07	−0.41	−0.24
	(867.16)		(−3.15)	

NOTE: T ratio is in parentheses.

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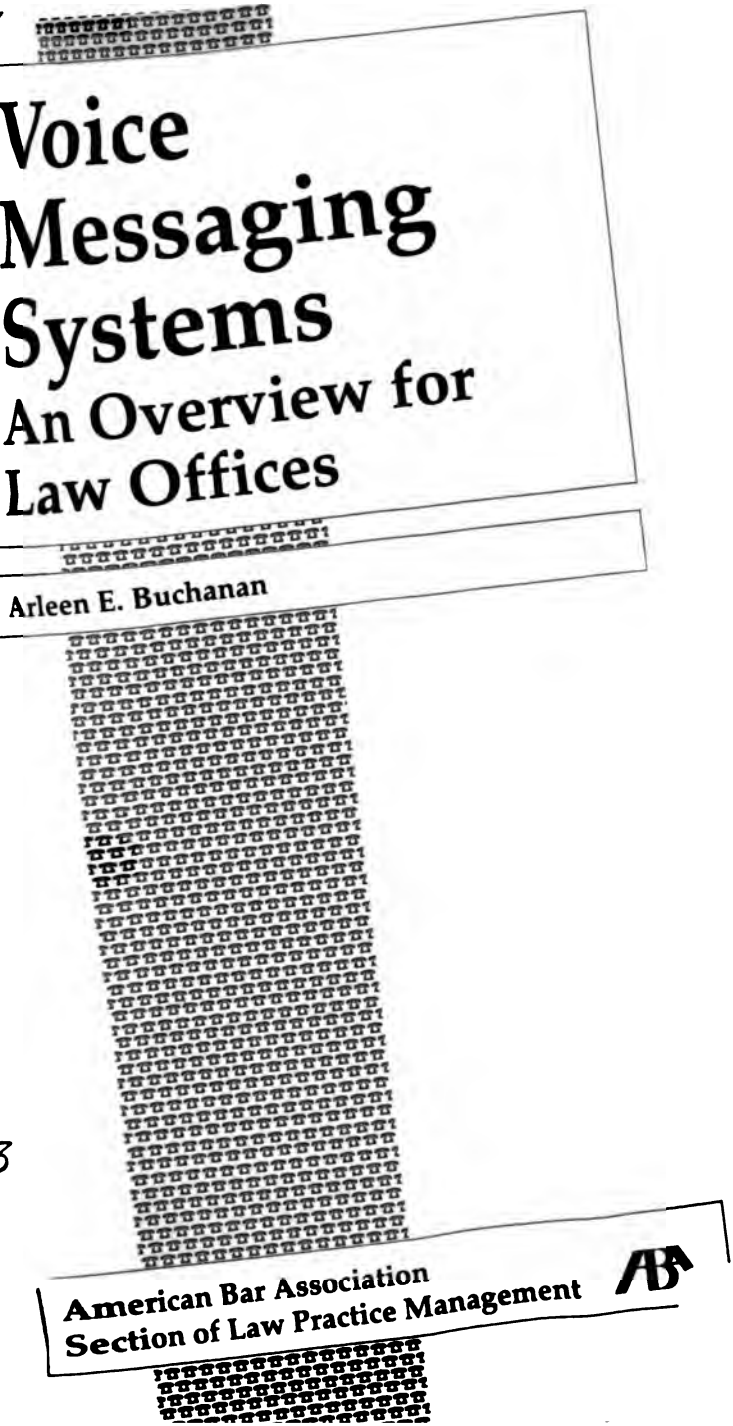
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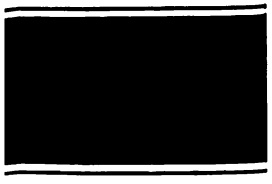

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Voice Messaging Systems

An Overview for Law Offices

Arleen E. Buchanan
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American Bar Association
Section of Law Practice Management

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CONTENTS

1. Voice Messaging Systems: What They Are, What They Do 1
   - The Marketplace 3
   - What a Voice Messaging System Can Do 6
   - Integrated vs. Interfaced Systems 8
   - How a Voice Messaging System Works 11
   - System Administration 13

2. Features and Benefits of Voice Messaging Systems 15
   - Important Terms 16
   - Most Commonly Used Functions 19
   - Applications in Law Firms 22
   - Benefits of Voice Messaging Systems 30

3. Designing, Selecting, and Implementing a Voice Messaging System 33
   - Design of a Voice Messaging System 33
   - Selection of a Voice Messaging System 39
   - Implementation of a Voice Messaging System 41
   - Training and Administration 43

4. Conclusion: The Future 45

Appendix A
Vendors of Voice Messaging Systems 49

Appendix B
Basic Features of Voice Messaging Systems 52

About the Author 55

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☎ CHAPTER 1

Voice Messaging Systems: What They Are, What They Do

Voice messaging systems are computer systems that perform a variety of telephone functions, including taking confidential messages, processing calls without human intervention, providing broadcast centers from which information can be disseminated to a large group of people, serving as off-hours answering services, and many more. The primary difference between a voice messaging system and a simple telephone answering device is that the information gathered in a voice messaging system can be edited, copied, and manipulated in a variety of ways.

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These systems are coming of age. The technology dates back to the late 1970s and has only been aggressively marketed as of the early 1980s, thereby spawning a major new industry. Improvements in disk storage technology and software developments have made what were once unwieldy systems not only extremely functional but also cost-effective.

The number of voice messaging systems installed in law firms is only now beginning to mirror the percentage of systems installed in the broader business market. As with many advanced technologies, law firms were somewhat reluctant to embrace voice messaging, partly because they perceive no practical applications, were concerned about confidentiality and client complaints, and, perhaps most importantly, had to make big investments of money and time to acquire and manage a system. Somewhat surprisingly, this reluctance has persisted in a profession known for its dependence on accurate telephone communications and its reliance on labor-intensive message handling systems.

These concerns are now outweighed by a host of benefits offered by voice messaging, including improved client service, potential savings of staff expense, round-the-clock communications service, improved lawyer efficiency, and better internal communications. In some cases, law firms have learned that their clients have come to expect voice messaging capability and are disappointed when it is unavailable. As voice messaging "interfaces" become more adaptable and easier to use and as

the introduction of PC-based systems brings the cost down, few law firms in the late 1990s will fail to have voice messaging available internally and for clients.

The systems' major benefit to law firms is the ability of lawyers and staff to communicate personally with other parties (lawyers or clients) in a nonsimultaneous fashion. This means that a lawyer can communicate information to another lawyer, regardless of the time of day or day of week, knowing that this information will be transmitted confidentially and accurately.

This book provides an overview of voice messaging technology and its leading vendors, highlights key elements and features of the process of selecting a system, and offers practical advice on the installation and administration of a voice messaging system in a law firm.

The Marketplace

At the end of 1986, there were approximately 2,000 voice messaging installations and an annual market estimated at approximately $150 million. With the industry growing at an estimated rate of 60 percent a year, vendors anticipate a billion-dollar industry for the 1990s. All existing telephone customers, including Centrex (non-PBX) users, are potential customers for voice messaging systems.

The first voice messaging systems were developed by IBM and AT&T, but now virtually all telephone system manufacturers have developed either proprietary voice messaging systems or have entered into dealership agreements with

manufacturers of voice messaging systems. The voice messaging industry is also populated with manufacturers who do not provide telephone systems.

While none of the approximately two dozen vendors completely dominates the marketplace, companies such as AT&T, Northern Telecom, and ROLM, which sell integrated voice messaging systems along with PBX equipment, and vendors whose systems integrate with a variety of telephone systems will have an advantage in approaching the marketplace. The key players that do not provide PBX equipment and control a large share of the market are Octel, which integrates with a large number of PBXs, and VMX, a pioneer and early market leader. The next group of vendors in market share includes Applied Voice Technology, Digital Sound Corporation, Centigram, and Genesis Electronics Corporation, each controlling approximately 5 percent of the market.

The market will continue to grow quickly as a result of an FCC decision allowing the Bell Operating Companies (BOCs) to offer voice messaging service. This was formerly considered an "enhanced service," which the divestiture agreement prohibited BOCs from offering. Now Bell Operating Companies will join other service bureaus offering voice messaging services to firms that want to use the service on a selective basis, have capital constraints, or merely want to defer making a commitment to a particular manufacturer. The demand for very large systems to provide voice services to telephone company customers has

already spurred a great deal of research and development, as vendors attempt to increase their systems' capabilities. During the 1990s, these services will be offered to small businesses and residences as well as to larger businesses.

Although systems are available for small to midsize firms, market acceptance will depend on whether there are practical applications. Firms should immediately realize efficiencies in service and communications, both internally and with clients. Many businesses will realize "hard dollar" savings. However, law firms typically will experience "soft dollar" savings, which frequently are more difficult to recognize and appreciate. The specific benefits to law firms are noted in the next chapter.

Another spur to market growth will come from the increased exposure of users to voice messaging technology as it becomes available, accepted, and, indeed, required by virtually every business and residence. Firms that do not have voice messaging systems will be the exception rather than the rule in the latter part of the 1990s.

Industry growth resembling the PC explosion is very possible, although it is not expected to occur as rapidly. One similarity to the PC explosion of the 1980s is the decline in pricing made possible by the use of PCs to operate small to midsize voice messaging systems.

The current explosion in system sales will continue to be fueled by the users and the applications they develop. When the majority of firms have systems, full appreciation of the technology

will develop professionwide. In coming years, voice messaging systems will be as ubiquitous as the receptionist and message pad—essential parts of the voice communication systems in today's law firms. And while it may seem that communications are being depersonalized to a certain extent, communications are, in fact, simply becoming more efficient, given our mobile and communications-intensive society.

What a Voice Messaging System Can Do

Voice messaging systems provide a wide range of capabilities allowing users to store and retrieve voice or touch-tone information and have calls routed according to touch-tone signals, such as pressing an extension number. Most systems can provide five key functions; law firms probably will not use all of these in the near future. However, the five capabilities illustrate the scope of the technology and portray situations in which lawyers can expect to encounter voice messaging technology when communicating with their clients, suppliers, and other businesses.

Voice Mail

Basically, voice mail is the ability of two or more telephone users sharing a system to send messages ("mail") to each other. Such users are known as subscribers. In a typical voice mail transaction, a subscriber dials a co-worker's extension number or "voice mailbox" and leaves a message. The co-worker may retrieve the message at his or her convenience.

Telephone Answering

Perhaps the best-understood function is telephone answering. If a system is integrated or interfaced with a telephone system, callers (both subscribers and nonsubscribers) will be forwarded to the voice mail system and asked to leave messages for subscribers.

Call Routing

The call-routing function enables persons calling from a touch-tone phone to route themselves to a desired extension or to general information messages. Lawyers might encounter this function when reaching a voice messaging system that is not fully integrated with the telephone system. For example, a lawyer might call a business's main number after hours and be asked to press the last four digits of the telephone extension or the letters spelling the person's name. The voice messaging system then routes the caller to the appropriate extension. Also known as an automated attendant function, this technology is finding a home with many businesses that use it in place of a full-time telephone operator.

Providing Information

Some voice messaging systems allow callers to retrieve information, such as schedules or instructions, stored by others. Callers can press a specific number to get specific information or can work their way through a system-guided tree or menu of choices. With touch-tone responses, the caller has the call routed to the desired information mailbox.

Transaction Processing

With transaction processing, subscribers can use the telephone as a data terminal. Touch-tone signals can access and update a database, as when ordering supplies, or can make travel reservations. Transaction-processing systems frequently are linked to a host computer, which maintains a database. Few law firms are now using this application area.

Integrated vs. Interfaced Systems

Early voice messaging systems were not capable of providing telephone answering because no data could be exchanged with the telephone system. Furthermore, the only people who could conduct "voice mail" on the system were subscribers who had access to the system via their own mailbox. Even this capability was awkward because many steps were needed to access the system. Thus, early systems were referred to as "closed." Subsequent systems and virtually all systems offered today are "open" in that they are connected to the telephone system and can answer calls that have been forwarded to them.

Within the category of open systems, there are "integrated" and "interfaced" systems. The terms refer to the extent to which the voice messaging system communicates with the law firm's telephone system. An integrated system exchanges data and communicates to a greater degree than an interfaced system does.

Interfaced systems provide voice messaging services in a self-contained unit from a firm's main

telephone system. This type of service is provided by a service bureau, or it can be purchased.

An integrated system helps callers in several ways. It offers automatic forwarding to a personal greeting, return to operator, and message-waiting notification.

Automatic Forwarding to a Personal Greeting

A caller may encounter one of several predetermined conditions at the called party's extension, such as a ring with no answer or a busy signal. In those cases, the telephone system will forward the call to the voice messaging system. In an interfaced system, a generic or "system" message is provided, and the caller will have to do something. For example, a message may request the caller to press an extension number or spell a name via the touch-tone tone pad to get to the mailbox of the desired party. In an integrated system, the call will forward automatically to the specific mailbox, where a *personal* greeting resides. Thus, the caller may hear the recorded voice of the called party requesting that the caller leave a message.

Return to Operator

One of the most frustrating experiences a caller can have is being locked in a voice messaging system with no ability to escape to a human being. The common term for this condition is "voice mail jail." Anyone to whom this has happened will be likely to reject the use of voice messaging. A key capability of a well-implemented, well-integrated system is letting callers know that they can talk to a live person without having to place another call.

This function is especially important to callers with rotary-dial telephones. An integrated system will, after a preset period of time without a touch-tone response, or upon request by keying a number or symbol on the touch-tone pad, return the caller to an operator or other preset location for live assistance.

Message-Waiting Notification

An integrated system will work with the capabilities of the telephone system to either illuminate a light on the user's telephone or provide an interrupted or "stutter" dial tone so that a subscriber knows upon returning to the office that the voice messaging system has taken a message. An interfaced system might be able to "out-dial" or call a telephone number at prescribed intervals to notify the subscriber that a message is being held.

Which Type of System Is Right for You?

These capabilities of an integrated system might seem to imply that there is no application for an interfaced system in a law firm. That is not necessarily the case, however. The application will dictate the type of service required. When the use is expected to be primarily internal, an interfaced system might be acceptable. For example, an interfaced system or a service bureau might prove helpful for a particular department or work group, where the lawyers are frequently out of the office and know that they will communicate regularly and effectively by intentionally calling the voice messaging system. However, a service bureau that requires callers first to dial out of the telephone

system might not be appropriate or efficient. Law firms typically prefer integrated systems. Integration is a key issue during the process of selecting a system. That is because it will determine the pool of vendors for a given application.

How a Voice Messaging System Works

The technologies used to accomplish the voice messaging functions, as well as myriad other features of these systems, are voice digitization and software interpretation of touch-tone signals from a user's telephone. Messages are "digitized," or translated into a binary code readable by a computer, and stored on a hard disk in the voice messaging computer. When it retrieves the messages, the computer translates them back into the original caller's voice, thereby maintaining the caller's mood and better conveying the true meaning of the words.

Any functional voice messaging system must have several attributes. These are a connection to the telephone system, a computer, a technique for digitizing, a medium for storing messages, and a method for interpreting the caller's instructions.

Connection to the Telephone System

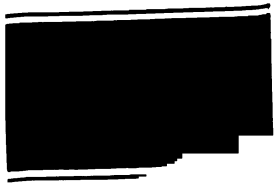
For either an integrated or an interfaced voice messaging system to work, it must be connected to the telephone system. It may be connected in one of several ways, depending on the combination of systems. In some instances, the voice messaging system is a stand-alone system, with telephone company lines directly attached. The number of

these lines or "ports" determines the number of communications that can occur simultaneously.

In a configuration where extension ports are used, the voice messaging system will appear to the telephone system as just another telephone line. Trunk connections are used when calls come through the voice messaging system first, before connecting to the telephone system. Tie line and RS232 data connections are used in addition to the extension and trunk connections to facilitate communication between the voice messaging system and the telephone system—for instance, to pass a signal from the voice messaging system telling the telephone system to disconnect a call or light a message-waiting light. Each combination of voice messaging system and telephone system will have a specific method of connection.

Computer

The controlling portion of the voice messaging system is the computer, which coordinates all of the functions of the system and manages the transactions. The computer can be a minicomputer, a microcomputer, or in some instances a shelf in the telephone system. In the past several years, PC-based systems supporting small-scale users, typically with requirements for two to eight ports, have proliferated. While the lower cost of these systems makes the technology available to the smaller firms, they seldom offer the richness of features available in larger systems, nor do they integrate as well with PBX telephone systems. As the technology continues to evolve, these conditions will improve.



Digitizing Technique

The voice messaging system converts analog voice to a digital format capable of being stored on a computer's hard disk. Digitizing techniques, which vary from vendor to vendor, determine how efficiently and accurately the system reproduces the voice messages. Furthermore, digitizing has a significant impact on a system as the system grows, because the digitizing technique affects the volume of voice messages that can be stored on the hard disk.

Storage Medium

The storage devices are typically Winchester-type hard disk drives. Some systems offer redundancy (backup copies of messages or system prompts) at various levels, but as a general rule such redundancy is difficult to cost-justify in a moderate-sized law firm.

Disk storage capacity dictates how many hours of messages may be stored on the disk drive. Capacity primarily depends upon the digitizing and voice compression techniques used.

Instructions

Users of the system activate its features by pressing the appropriate buttons on a touch-tone telephone. The system interprets the touch-tone signal (or, more correctly, the dual tone multifrequency (DTMF) signal) and performs the action called for by the signaled instructions.

System Administration

The role of system administrator, while not time-consuming, is very important. In addition to

understanding the use of the system, the system administrator must anticipate required changes to the system by monitoring the traffic statistics. This person can add and delete mailboxes, assign users the appropriate class of service capabilities, authorize the use of certain mailboxes, and coordinate activities with the PBX vendor if it is different from the vendor of the voice messaging system.

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CHAPTER 2

Features and Benefits of Voice Messaging Systems

Today's voice messaging market evolved because of the tremendous inefficiencies inherent in all telephone systems. The inefficiency, known as "telephone tag," is the most basic problem addressed by voice messaging systems. Users can avoid telephone tag by leaving detailed messages in the system.

One difficulty today's vendors have in selling the voice messaging concept to law firms is in helping lawyers understand the other benefits of a system. Voice messaging systems have features

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and capabilities that go far beyond the telephone tag solution. It is on this area of law firm applications that consultants, vendors, and users need to focus.

The only requirement for using the dozens of voice messaging system features is a touch-tone telephone. Callers with a rotary-dial telephone will be able to leave a message but will not be able to retrieve messages. While features vary from system to system, virtually all systems have the capabilities outlined in this chapter.

Important Terms

Several terms are helpful in understanding voice messaging features and how they work.

Voice Mailbox

A voice mailbox is a software-defined area on a hard disk where messages are stored. A mailbox number is assigned to each individual subscriber or user. The user controls security by assigning a private password (up to 24 digits) to the mailbox. The system administrator controls various parameters such as the number of messages that can be stored, the length of each message, the amount of time a message will remain stored, and numerous other features. Messages in the mailbox can be retrieved only by the individual user and, in some instances, by the system administrator. Callers outside the system and other subscribers may leave messages in a mailbox that is not their own, but they may not listen to or change messages in that mailbox.

Voice Message Structure

Each voice message has two parts: header information, which is the equivalent of an envelope, and the message itself. The header information includes the time and date of the message and the sender or recipient's identity (name or extension number). All information is stored on the disk.

It is interesting to note that voice messaging technology is such that if a message is intended for numerous recipients, that message is stored only one time on the disk. This minimizes the storage requirements that would exist if the same message were stored in all recipients' mailboxes.

Mailbox Greetings

When a caller enters a mailbox, a prerecorded message is played. In a fully integrated system, the caller will be forwarded automatically (under certain preset conditions) to the person's mailbox. A typical subscriber's personal message might be:

> Hello, this is *(subscriber's identity)*. I'm not available at the moment. At the tone, please leave your name, number, and a detailed message. I will return your call as soon as possible. If you need immediate assistance, please press 0, and you will be connected to *the operator*. Thank you.

If the system is interfaced, the caller will typically hear a general system message, then will dial the called party's extension number.

Naturally, greetings can be tailored to a specific application with more or less information provided. The subscriber can change greetings at any time from any place by using a touch-tone tele-

phone. This allows great flexibility, so that a subscriber might choose to tell callers when and how often he or she will be checking for messages, or whether an absence is extended, allowing the caller to make decisions regarding the importance of the message and whether to take some action other than simply leaving a message.

Class of Service

The system administrator assigns each subscriber and each mailbox a class of service that determines what features will be available to that subscriber. Class of service restrictions permit certain capabilities, such as extended storage capacities, to be given to users on a restricted basis.

System Prompts

A series of prompts that describe the various options available instructs callers and subscribers in how to use the voice messaging system. A caller's responses can be either numeric or mnemonic, depending on the system. The prompts heard by a subscriber will depend upon the level of feature access (class of service) allowed to that individual. Most systems offer various levels of prompts including a "help" option. Recorded prompts can be supplemented with faceplates and/or user guides on the telephone equipment.

Experienced users will not have to listen to all possible options. Nearly all systems allow users to skip prompts by simply pressing the button of the feature they wish to activate. Experienced users help maximize the use of the system, as skipping prompts reduces their access time on the system.

Guest Mailboxes

A guest mailbox is a way of communicating in the voice messaging system with someone who is not on site or who is intended to be a part of the system temporarily. A subscriber with the appropriate class of service can establish a mailbox for a guest, who can then dial into the system and retrieve messages left for him or her. This enables subscribers to communicate extensively with an "outsider" in the same way that they communicate with each other. Many law firms are unaware of the potential benefits of this feature for their clients.

Security

To protect the privacy of each mailbox, each subscriber is assigned a personal password of up to 24 digits. This ensures the confidentiality of sensitive messages. Typically, security can be bypassed only by a systems administrator or, in the event of service problems, by the manufacturer's maintenance personnel.

Most Commonly Used Functions

A law firm uses voice messaging primarily for just that—messaging. The system provides some basic functions for that purpose, some of which help in reviewing messages, and others of which support sending messages.

Reviewing Messages

Messages may sometimes be categorized by the sender as "normal" or "urgent." Other systems might categorize messages according to whether

they are new messages or old messages (already "read" once). Generally, when the subscriber is accessing his or her mailbox, the system presents a count of the number and type of messages stored there.

Upon accessing his or her personal mailbox, the subscriber can typically perform several message review functions. Most voice messaging systems offer all or some of the following capabilities to subscribers reviewing their messages:

- *Play back* messages, including options for fast forward, rewind, pause, and move to the next message.
- *Scan* quickly through the mail, listening to the "header" or envelope information and determining which messages should be heard. This quick scan capability might be given to a secretary for noting urgent messages. When the subscriber is scanning, the system does not play the message content.
- *Skip* a message and go on to others that might be more urgent.
- *Reply* to messages from other subscribers by pressing the reply key. This eliminates the necessity for returning the call.
- *Save* messages right in the mailbox or possibly "archive" them for long-term storage and future reference.
- *Erase* a message.
- *Copy and send* a nonprivate message, allowing a subscriber to forward the original message with his or her comments to other subscribers.

- *Adjust volume* controls to compensate for poor transmissions.

Sending Messages

Sending a voice message is not unlike writing a letter or dictating a memo. This method of communication is quickly replacing many of the more traditional types of communications, especially in law offices that require extensive internal communications. A voice message is much less complicated and less time-consuming because it requires no use of support staff. In most cases, the sender can edit, delete, and/or rerecord the message.

Sending a message to a mailbox on the same system is quite simple. While the sequence of commands varies by system, in general the sender records a message and, with a few keystrokes on the telephone, addresses and delivers the message to the recipient's mailbox.

- *Recording* a message is much like dictating a letter. Many systems allow the subscriber to pause, replay the recorded portion, rerecord, erase, or delete the entire message, as with dictating equipment.
- *Message confirmation*, like certified mail, may be requested by a subscriber who wants to be sure that the message has been delivered. The sender automatically receives notice when the recipient listens to the message.
- *Prioritizing* a message allows a sender to categorize messages as Urgent, Normal, or Return Receipt Requested.

- *Privacy* can be invoked so that a particular message cannot be copied or sent to any other mailbox.
- *Distribution lists* created by the sender or the system administrator allow the subscriber to use a single set of commands to send the same message to numerous other subscribers.
- *Future delivery* allows the sender to record messages for delivery at a designated time in the future.
- *Address correction* in some form or another is available in the event the sender misdials an extension or makes some other error. Usually, the system plays the intended recipient's name or extension number. If a message cannot be delivered, the undelivered messages are returned with an explanation of the problem.

These messaging features are adequate for most law firm applications. Numerous other features are typically used for other business applications and eventually may find their way into law firms. Here are two examples of such features:

- *Out-calling* capability means that under predetermined conditions, including receipt of a message marked Urgent, the system activates a beeper or pager.
- A *verbal bulletin board* is a call-in only mailbox where all callers receive the same information.

Applications in Law Firms

Law firms, while seldom on the leading edge of technology, are quickly adopting voice messaging technology because they see an opportunity to

improve communications internally and externally. Many systems are installed initially to solve communications and coverage problems within the firm. Recognizing the fact that more efficient operations and communications will translate into time savings, cost savings, and greater efficiency, law firms are looking at the technological alternatives available with a more open mind.

With case-related communications resolved more expeditiously, the same number of people theoretically can handle more cases. Greater efficiency and accuracy save clients money. Work product can be improved through more frequent internal and external communications with clients. Use of guest mailboxes for selected clients or lawyers outside the firm broadens the system to the extent that the same efficient and confidential communications achieved internally can be achieved with outside parties, enhancing the timeliness and accuracy of voice communications.

This analysis of the application of voice messaging technology to a law firm makes a couple of assumptions. First, one of the primary objectives of a law firm is to serve its existing clients more efficiently and to handle an increasing work load without necessarily adding staff. A further assumption is that clients are more willing to pay for work that is accomplished in a smooth, timely, and accurate manner.

Several obstacles hinder achievement of these objectives: The lawyer is not available to take a client's call. The client is not available to take the attorney's call. Support staff is busy or not avail-

able. Written messages are incomplete or inaccurate. Preparation of memos is time-consuming. Physical movement of paper is slow. Meetings are time-consuming and make lawyers unavailable. Voice messaging systems can be designed to solve many or all of these problems.

Call Coverage

The most obvious, most often discussed, and most controversial application for voice messaging in a law firm is call coverage. Opinions regarding automatic call forwarding of client calls to a voice messaging system are frequently diverse and often emotional. The point to be stressed is that *automatically* forwarding outside calls to the voice messaging system is *optional*. Much of what happens automatically with the calls is determined by the software flexibility of the firm's telephone system and the expertness of the system implementation. Therefore, if the firm wants any call forwarding, internal or external, it is important to understand the capabilities of the telephone system in detail. The voice messaging system is merely *receiving* the call routed through the telephone system.

Client (external) calls need not be automatically forwarded to the voice messaging system. Secretarial coverage of calls is still possible. The system can be designed so that calls first ring at the lawyer's and/or secretary's desk. If the lawyer is unavailable, the secretary can offer the client a choice: The client can leave a message with the secretary or in the lawyer's mailbox. If the secretary is unavailable, calls can forward automatically

to the voice messaging system or to a backup coverage point such as an operator or message center, where the client has the same options.

The emotional objection to forwarding calls automatically to the voice messaging system rarely extends to internal calls. The benefit of automatically forwarding internal calls to the voice messaging system is that lawyers and paralegals can leave one another complete, confidential, and detailed messages without distracting secretaries from other duties. When internal calls forward to a message center, the relief granted secretaries is immediate and often startling. When a lawyer wants to respond to a message from another lawyer, the response can be immediate and automatic.

A further benefit of having these messages in the voice messaging system is that if a lawyer wants to share the information contained in a message with other members of the case team, he or she can distribute the verbal message to other team members with a couple of keystrokes on the telephone.

The good news for the application of call coverage is that it is flexible and easy to configure from the standpoint of the voice messaging system. Options may be limited only by the flexibility of the software of your telephone system.

Communications While Out of the Office

Traveling lawyers can be extremely frustrated in their attempts to communicate with their secretary and other lawyers back at the office, especially when traveling in a different time zone. For a

lawyer spending the day in court or in depositions in a distant city, breaks may come during lunch or after hours at the firm's office. A voice messaging system allows off-site lawyers to retrieve their messages at any time, day or night, from any location with a touch-tone telephone.

The out-calling feature can be put to good use in certain cases. For example, assume that someone at the firm discovers an important piece of information and it is critical that this information be passed to the responsible lawyer immediately. That lawyer is in court out of town and in a different time zone. The voice messaging system can be programmed to call a beeper number with the announcement that important information awaits the lawyer. The lawyer then calls his or her voice mailbox at the earliest opportunity and retrieves this critical information. This eliminates the need (and the inconvenience) for someone to remain deskbound awaiting a call from the traveling lawyer and not knowing when or whether that person will call.

Let's take this example a step further. The urgent information is relevant to a different case. The lawyer can comment on the message, copy it in the voice messaging system, and send it with instructions to another lawyer for immediate action. All this happens without the two lawyers actually speaking.

Case Team/Mailbox

Many times in a complex litigation case, a number of lawyers, paralegals, law clerks, and

others combine their work efforts as a litigation team. Team members constantly try to update each other on the status of new findings and happenings. Frequent ad hoc meetings are held in hallways, at the coffee station, and elsewhere. Invariably small bits of useful information are lost in the shuffle.

A voice messaging system can help. Assume that a mailbox is established for a particular case and that the mailbox has a distribution list that includes the mailboxes of all the people on the case. Whenever some new information regarding that particular case is discovered, it is recorded in the mailbox. Depending on the circumstances, case team members can call that mailbox, or the messages can easily be copied and sent to the private mailboxes of all the team members. If the information is critical, the sender can request confirmation that the message was received. If case team members change, distribution lists can easily be changed.

Round-the-Clock Communication

While the benefit of being able to communicate at any time on any day has already been mentioned in connection with other features, it bears repeating. Consider this scenario: A lawyer, after a strenuous day of golf or tennis, has a thought regarding a particular case. But it is Saturday and the lawyer is leaving on vacation the next day. A simple telephone call to the office will permit him or her to leave this set of instructions, in multiple mailboxes if required, with the comforting knowl-

edge that the message will be delivered first thing Monday morning.

System subscribers can communicate with each other effectively and quickly by leaving messages or questions, such as "Did you check this?" or "Read case #27." Another helpful technique is to leave instructions for administrative staff, such as "A long brief is coming Tuesday. Schedule overtime in the word processing center."

Elimination of Short Memos

The voice messaging system is an easy alternative to having brief memos typed and physically distributed. Voice messages can be used to announce a meeting, inform firm members of a new client so that they can begin to check for potential conflicts, and circulate virtually any piece of information important to some or all firm members.

Verbal Bulletin Board

The system can also serve as a verbal bulletin board by making messages available to all or several firm members. The applications for this feature are virtually limitless. Several different bulletin boards can be established for a variety of purposes and made accessible to any combination of users, both inside and out. For example, a bulletin board might be devoted to providing updates on new cases, personnel items, and other information about goings-on at the firm. Or the word processing department might keep the status of projects, updated periodically, available to firm members without the need for interruptions to word processors' work. If travel schedules are not

too unwieldy, a mailbox can be established to tell callers who is out of town and for how long. Some firms record a careful spelling of the firm's name and address or directions to the office in a mailbox used by the telephone operator to offload this repetitious work.

Personal injury firms that handle a high volume of inquiry calls might provide a "Know Your Rights" mailbox for product liability or accident victims. After the message is played, callers can be offered an opportunity to speak to a lawyer by pressing a key on their telephone.

Nonsimultaneous Communications

"Real-time" communications—those in which all parties must participate at the same time—are often inefficient. Many messages do not require a reply; they are merely a communication of information or questions that have to be researched. Voice messaging systems transmit these types of messages more efficiently by allowing for nonsimultaneous communications. Voice messages are documentably shorter, because they avoid a lot of time-consuming chitchat and the need to socialize when a call is placed. They also eliminate the need for callbacks or "telephone tag" in order to impart a simple message.

Voice Mailboxes for Clients

Voice messaging enables a firm to enhance communications with certain clients by giving them guest mailboxes on the system. A guest mailbox permits a lawyer with the firm to leave the client updates such as settlement offers or other

confidential information that may not be appropriate for leaving with a secretary. The message is always communicated in the lawyer's voice, thus conveying the proper emphasis and emotion. This special service can help to distinguish one firm from another.

Benefits of Voice Messaging Systems

The full range of benefits of voice messaging systems in law firms is still being determined. We know that much of the internal communication in a law firm is essentially one-way transmittal of information. Some estimates put the one-way percentage at 50 percent and higher. If a voice messaging system improves this one-way flow of information and relieves the lawyer's staff by minimizing 50 percent or more of the need for handwritten messages, the office has become more efficient.

Among the benefits identified so far, voice messaging lets firms do the following:

- Relieve secretaries of some or all message-taking duties.
- Communicate confidential information effectively.
- Make lawyers available to clients and co-workers 24 hours a day, seven days a week.
- Eliminate short memos and meetings.
- Promote information sharing.
- Reduce the need for message center personnel.
- Ensure that communications are accurate and recorded in the sender's own voice.
- Retrieve messages from anywhere at any time.

- Enhance client responsiveness.
- Better control internal information.
- Keep calls shorter and, therefore, less costly.

This short list of benefits merely begins to define the potential that voice messaging holds for the law firm. Each firm will find applications that will improve communications both internally and externally and will make them more effective in their practice.

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☎ CHAPTER 3

Designing, Selecting, and Implementing a Voice Messaging System

Design of a Voice Messaging System

Never underestimate the challenge involved in properly designing a voice messaging system. Since it is rare that the system is replacing an existing one, no statistics will be available to quantify the requirements for access ports and storage capacity for the telephone/voice messaging system. While there are industry standard assumptions that can be made, until a system is

installed and operating in a specific law firm environment with actual experience being monitored, system design will continue to be an inexact science at best. In most cases, the firm would benefit from seeking professional help in designing a system.

The issues of integration with a particular telephone system can be extremely complex, even though nearly all vendors claim integration capabilities with various telephone systems. The extent to which the systems are truly integrated is sometimes never known until a system is installed according to the firm's desired design. Sometimes it is only then that the limitations surface. This is partly because many integration packages are new and a particular vendor's experience in integrating with a specific telephone system may be limited or even nonexistent.

The two major design elements of the voice messaging system are ports and disk space or storage capacity. Sizing each of these elements requires planning regarding how the system is to be implemented and used.

The Design Process

The first step in the design process is to determine how and by whom the system will be used initially, closely followed by how the system is expected to be used over the long term. Issues such as internal and external use must be explored, because opening up the system to a larger universe of users will affect its required size and traffic-handling capacity. And while some systems are

fairly modular in growth, there are often significant jumps in price of different models within a particular product line. The failure to properly analyze these factors could lead to much greater costs later on.

The next step is to determine whether the firm's existing telephone system limits the choice of voice messaging systems. It is possible that all the firm's requirements can be accommodated by the existing telephone system, but more often the telephone system forces certain limitations that may control the way the voice messaging system is selected. In some rare cases, accomplishing the firm's goals may require replacing or upgrading the existing telephone system. This option should not be rejected out of hand, since the potential benefits of the system may justify the cost of a new or upgraded telephone system.

Determining the required and desirable features is the next step. The table in Appendix B presents a comprehensive list of features. As with all system purchases, certain tradeoffs in feature availability are to be expected.

Three parameters determine the desirable system size: (1) the number of mailboxes the system can support, (2) the number of access ports, and (3) the hours of message storage capacity. In establishing each of these parameters, the firm should use two categories: necessary and desired. The voice messaging system selected must be designed to support all three capacities for both the initial and long-term applications desired by the firm.

Number of Mailboxes

The number of mailboxes is not merely a count of the current number of lawyers in the firm. The firm also must answer a number of questions: Who will have mailboxes besides the legal staff? Do secretaries need mailboxes? Is one mailbox for word processing sufficient, or should everyone in that department have one? How many guest mailboxes are anticipated for outside lawyers or clients? How many information mailboxes, team and case mailboxes, and so on will be necessary? What is the projected growth of the firm, in the near and long term?

Number and Type of Access Ports

In determining the number and type of access ports required, the best that a firm can do is to estimate. The true requirement depends on the way the firm uses the system, the peak traffic periods, the expertise of the users (how long they tie up the system listening to prompts), the length of the average message, and who is actually using the system.

Note that a port is used for longer than the time to record the message. This is because an announcement to the caller is made, the message is left, and the message is retrieved. This is a critical design consideration.

The type of ports will also vary depending on how the system is implemented and how the existing telephone system is connected to the voice messaging system. If multiple types of access to the system are to be provided, a port dedicated to a

particular function might also be advisable. This will influence the number of ports required.

To determine the number of ports, the following questions must be answered:

- What is the length (in time) of the average message?
- How much time is needed to record and edit the typical message?
- How much time is spent retrieving and listening to messages?
- What is the average time for greetings?
- How many users will be on the system?
- What is the average number of messages per day per user?

Hours of Storage Required

Once again, with little in the way of experience to rely on, the firm has to use a best-guess approach to sizing the storage capacity of the system. How subscribers use the system will determine the amount of storage required. Another factor is how tough the system administrator will be regarding capacities provided to individual users and the length of time messages will be stored. Clearly, a firm will want to provide subscribers with the amount of storage they need, but it also must be sure that the system's resources are managed properly, as this is one area that is very controllable.

The key factors are the number of users, the average length of a message, and how long the messages will be retained on the system. Eventually subscribers will be trained to erase all but a

few messages immediately upon listening to them. A large number of "archived" messages will significantly increase the storage required.

To determine the storage hours required, the following information must be accumulated:

- Length of average message.
- Average number of messages per day per user.
- Average retention time of messages per user.
- Number of users.
- Special requirements for application-based mailboxes.

There are, of course, some industry rules of thumb regarding the requirements for ports and storage, but one must be extremely careful in using them. It is often helpful to speak with someone at another law firm to determine how that firm is managing its system and whether its method is compatible with your applications. Often the other firm's configuration will suggest the proper direction to be heading. For assistance in determining your specific requirements, a consultant can be very useful.

The impact of changes in any of these requirements is not only costly but can seriously hamper the effectiveness of the system and certainly will color the way the users feel about the system. Users will be unimpressed at best if they encounter a message that says they cannot leave a message for a subscriber because the mailbox is full or if they encounter a busy condition when trying to access the voice messaging system. This is unfortu-

nate, for problems often arise in a high-quality system that has been poorly implemented, sized, or designed. Optimum use of system capacity therefore depends on properly managing and designing the system.

Selection of a Voice Messaging System

Flexibility is vital to the selection of the proper voice messaging system. The purchaser should assume that applications will change as users begin to recognize the power of the system they have purchased. Selecting a voice messaging system that is compatible with only the current telephone system may not be a wise choice if the existing system is nearing the end of its useful life. Flexibility is also important in that the law firm is seeking a system that will enhance and not inherently change the way in which it does business.

The ability to link voice messaging systems in networks is relatively new and requires that many manufacturers rethink some of their engineering. As systems proliferate, more users will require system-to-system communications capability. In today's environment of emerging industry standards, this is difficult with systems manufactured by different vendors installed in various offices. Until the standards are established and met by the manufacturers, purchasers of multiple systems for multiple sites are often better off to make a commitment to a single vendor. Either way, the firm will want to know that the selected vendor(s) is participating in the development of industry standards and working toward making its system

compatible with the systems of other manufacturers.

Consequently, as mentioned numerous times, integration is a critical issue. The telephone and messaging systems must be able to work together in a way that does not sacrifice the features of either system.

Trial of the System

One of the best ways to evaluate a system is to try it. Experiment with the various systems being examined. Get a guest mailbox, record your message, establish the parameters, listen to the prompts, use the features as if you were a client experiencing them for the first time.

Are the prompts clear and easy to follow? Are time and date provided on each message automatically or upon request? Which way do you prefer? How is fast forward activated? Can you get live help if you need it? Are the menus set up logically? Are there too many special or unique features? Can you skip prompts when you become familiar with the system? Is out-calling available? What other law firms are using the system, and how do they like it?

Incremental Growth Costs

As with any other major investment in a sophisticated system, you need to know the incremental costs of additions to the system. Do you have to purchase eight port increments at a time, or can the system grow in smaller increments, more appropriate to your firm size? What are the increments of disk storage? Do they make sense in your

application? And, of course, consider what the total expansion costs.

Maintenance

Maintenance prices of voice messaging systems vary extensively. In some instances, one vendor has charged three to five times as much as a competing vendor. Distributors new to the technology may not yet have a good handle on the true cost of maintaining the system, so they may be under- or overcharging for maintenance based on a lack of knowledge and practical experience.

System Capacity

As important as the cost of incremental growth is the importance of the system's maximum capacity. The required maximum capacity for the firm can be difficult to pinpoint, since the initial sizing is based on many unknowns. Nevertheless, the buyer must at least have a good idea of the ultimate size of the system or the migration path within models of the system. Distinguish between the system's maximum capacity and its maximum effective capacity. Is the effective capacity enough to satisfy the users' needs? Too many claims of "unlimited capacity" are made. The risks of inadequate capacity are that an access line will be unavailable or that all messages might have to be erased daily, making it less likely that users will accept the system.

Implementation of a Voice Messaging System

Effectively implementing a voice messaging system in a law firm is challenging and rewarding.

Implementation of features and applications should be a gradual process. Initial training should include only the basic features, with follow-up training done when users are comfortable with the system.

One method of implementation is to begin by introducing the system only to internal users. This allows them to become familiar with the system and to develop a working knowledge of its features. This also allows the system administrator to begin measuring traffic and understanding exactly how much of the capacity is being used for internal purposes only. Lawyers can then introduce their clients to the system, explaining its purpose of enhancing communications between the parties, reassuring clients that there is always a way out of the system, and demonstrating service benefits in a positive and personal way. In contrast, throwing clients into a system with no warning invites a negative response.

The objective of the implementation process is to achieve the benefits the firm sought when it procured the system. Enthusiastic involvement of the entire firm in the process makes the system a complete success. However, not all lawyers can be expected to support the system, or even to use it at first. Thus, implementation of this type of system should be gradual. As the system is used internally, its benefits will be recognized and it will attract new users.

Members of the firm should view the newly installed system as though it were a new tool. They should anticipate adjustments and fine-tuning as

new system features are introduced and specific applications are discovered.

Training and Administration

The methodology for training people to use voice messaging systems must be geared toward motivating the user to be interested and active in messaging concepts. A good initial strategy generally is a nonthreatening procedural orientation introducing only the most basic features to the majority of users. The definition of "basic" features will vary from firm to firm. Essentially the objective of the initial training should be for users to send and retrieve messages comfortably. A few specific applications can be introduced along with the basic concepts of voice messaging. The initial training should not be a detailed presentation of every system feature. A comprehensive, "gee whiz" view of the system is time-consuming and unproductive.

It is a good idea, whenever possible, to accomplish real tasks in the session. Let users initialize their mailboxes, record their greetings, establish passwords, and send and receive messages. With this accomplished, subscribers can begin using the system immediately, without the trepidation associated with first-time use. Even if users do not attend a formal training session, most systems provide enough prompts to allow them to follow along successfully. The key benefit of formal training is to stimulate users to become enthusiastic about and comfortable with the system.

The firm should provide an opportunity for subscribers to become *active* users immediately.

To encourage subscribers to check their voice mailbox, the system administrator should send messages frequently. These messages can be brief announcements about the firm or even a description of the "feature of the day."

Since not all the features of the system are introduced in the initial training session, there should be a follow-up education program with a planned migration to advanced features. Most times, this progression will occur much faster than anticipated, but it is a good idea to schedule a class every few weeks. After several weeks of using the system, users are frequently asking, "OK, so what else can the system do?"

To facilitate a good rapport with the users, the system administrator should encourage them to communicate with him or her. There are a variety of ways to do this. One is for the system administrator, upon reviewing usage reports and seeing lack of activity, to schedule a personal training session. Other means of enhancing communications include sending users a questionnaire regarding features that they find useful and sharing shortcuts, tips, and specific applications as they are developed throughout the firm.

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☎ CHAPTER 4

Conclusion: The Future

Future applications and developments in voice messaging technology are closely tied to the overall development of office systems. The most significant advances must be made in the integration of all office automation systems. The real challenge will be managing all of the information systems that will be available to the end user.

It is conceivable that the user could have a number of places where messages of different types are stored and will require a notification system that incorporates all of the systems. Corporate cultures, which are acknowledged to be

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several years ahead of most law firms in the implementation of these technologies, are addressing the problems of communications between electronic messaging and voice messaging systems, and solutions are being developed. With limited implementations, examples of these communications are between IBM's PROFS and ROLM Phonemail systems and between DEC Mail and VMX, in which notification of a voice message will appear on the electronic mail screen.

Other advances will include the ability to translate a spoken message into text. While the technology exists today, there are so many limitations that the capability is not yet useful or practical for most applications.

The networking of voice messaging systems so that systems developed by different vendors can communicate will become available because the market is demanding it. The first sets of suggested standards were issued in February 1990. The industry group that developed the standards is not established as a standards body, so its work product, called AMIS (Audio Messaging Interchange Specification), is not a domestic or international standard per se. Although AMIS is not an official standard, many purchase specifications are requesting bids only on systems that comply with it. Official standards are not yet developed, but AMIS will certainly have an impact.

The future developments in the voice-processing industry will involve networking, information retrieval, data and order entry, speech synthesis, voice recognition, and integration with all office

systems, including facsimile. Systems installed today provide real solutions to some of today's communications problems in a busy law office. The future developments and their applications in law firms will be part of the growing sophistication of consultants, vendors, and law firms, as they establish better processes for developing applications and improving implementation procedures.

If you can, move quickly to install and experiment with a voice messaging system. The benefits will become quickly apparent, and those that you anticipate will be expanded upon, limited only by the creativity of the lawyers and staff using the system.

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☎ APPENDIX A

Vendors of Voice Messaging Systems

Active Voice Corp.
101 Steward St., Suite 1120
Seattle, WA 98101
(206)441-4700

Applied Voice Technology, Inc.
P.O. Box 97025
Kirkland, WA 98083
(206)820-6000

AT&T
(800)247-7000

Boston Technology, Inc.
100 Quannapowitt Parkway
Wakefield, MA 01880
(617)246-9000

Brooktrout Technologies, Inc.
144 Gould St.
Needham, MA 02192
(617)449-4100

Centigram Communications Corp.
91 E. Tasman Dr.
San Jose, CA 95134
(408)944-0250

Comverse Technology, Inc.
170 Crossways Park Dr.
Woodbury, NY 11797
(516)921-0470

Dialogic Corp.
300 Littleton Rd.
Parsippany, NJ 07054
(201)334-8450

Digital Sound Corp.
6307 Carpinteria Ave.
Carpinteria, CA 93013
(805)566-2000

Dytel Corp.
50 E. Commerce Dr., Suite L
Schaumburg, IL 60173
(800)223-2727

Genesis Electronics Corp.
3078 Prospect Park Dr.
Rancho Cordova, CA 95670
(800)222-4634

Glenayre Electronics
4800 River Green Pkwy.
Duluth, GA 30136
(800)866-4002

Miami Voice Corp.
3319 N.W. 74th Ave.
Miami, FL 33122
(305)593-6077

Natural Microsystems Corp.
8 Erie Dr.
Natick, MA 01760-1313
(800)533-6120

NEC America
8 Old Sod Farm Rd.
Melville, NY 11747
(516)753-7000

Northern Telecom, Inc.
(800)328-8800

Octel Communications Corp.
890 Tasman Dr.
Milpitas, CA 95035-7439
(408)942-6500

ROLM Company
4900 Old Ironsides Dr.
Santa Clara, CA 95054
(800)538-8154

Toshiba America, Inc.
9740 Irvine Blvd.
Irvine, CA 92713-9724
(714)583-3700

VMX, Inc.
17217 Waterview Pkwy.
Dallas, TX 75252-8004
(214) 907-3000

☎ APPENDIX B

Basic Features of Voice Messaging Systems

- Message Creation
  - Re-record
  - Pause
  - Review
  - Edit
- Addressing Messages
  - By name
  - By extension number
  - Verify destination
  - Group distribution lists
  - Broadcast
  - Future delivery
  - Mark private
  - Mark urgent
  - Confirmation of receipt
- Message Review
  - Skip
  - Cancel
  - Pause
  - Fast forward
  - Reverse
  - Adjust speed
  - Adjust volume
  - Scan
  - Save/archive
  - Delete
  - Play header ("envelope") only
  - Time and date

- Reply to Messages
  - Respond automatically
  - Verify destination
- Copy a Message
  - Attach comments
  - Verify destination
  - Send copies to multiple destinations
- Message Notification
  - Call subscriber on premises
  - Call subscriber off premises
  - Call beeper
  - Message waiting light
  - Stutter dial tone
- Message Forwarding
  - To personal greeting
  - To system greeting
- Access to live assistance
  - Operator
  - Programmable extension
- System Management
  - Administration without system interruption
  - Statistics
    - individual port
    - detailed user statistics
    - disk utilization
  - Menu-driven screens
  - Alarms
    - remote
    - on premises
  - Reports
    - detailed system configuration
    - subscriber profiles
    - system error history
    - directories

- Networking
  - Uniform numbering plans
  - Types of lines to connect systems
  - Store and foreward capabilities
- Miscellaneous
  - Override prompts
  - Variable levels of prompts
  - Access to "help"
  - Tutorial
  - Classes of service
  - Passwords
  - Guest mailboxes

About the Author

Arleen E. Buchanan has worked in the telecommunications industry for twelve years, most of the time in a consulting capacity with law firms. She is currently a technology consultant with Altman Weil Pensa, where she offers consulting services to law firms in the area of telecommunications. A proponent of using technology for the benefit of the firm and its clients, Ms. Buchanan has implemented numerous voice messaging systems with her law firm clients.

A graduate of Douglass College, Rutgers University, Ms. Buchanan has written numerous articles on telecommunications subjects, including "Call Flow in the Law Firm," "Trends in Long Distance," and "Automated Cost Recovery Systems and Procedures." Her writings have appeared in the *National Law Journal*, The *New York Law Journal*, *Accounting for Law Firms*, *Report to Legal Management*, and many other publications.

Ms. Buchanan is a member of the Section of Law Practice Management's Electronic Communications Interest Group.

Selected Books from the Section of Law Practice Management

Art of Managing Your Support Staff. Includes approaches and techniques for screening and finding a first-class secretary or assistant. Has sample evaluation forms, interview questions.

Basics for Writing Your Law Firm Brochure. Gives advice for planning and creating a brochure. Includes samples of brochures produced by other law firms.

Beyond the Billable Hour. A collection of articles on the subject of alternative billing methods, including value billing. Contributors include small, medium, and large firm practitioners, consultants, and general counsel.

Building Your Law Firm with Associates. Outlines a method for finding, training, and retaining new associates. Includes ways to shorten the learning curve, become a better mentor, be more productive with your new hire.

Compensation Plans for Lawyers and Their Staffs. In this book are discussions on formulas, alternatives, and guidelines for establishing compensation plans for your entire office.

Corporate Counsel's Computer Guide: How to Develop and Use In-House Legal Systems. A practical guide for developing and implementing an information system within a corporate system network.

Flying Solo. A collection of 48 articles discussing major aspects of starting, managing, and maintaining a successful solo practice.

From Yellow Pads to Computers, 2nd edition. 40 chapters with real-life computer applications that focus on practical solutions. Especially for the attorney who's been too busy or afraid to use a computer.

Identifying Profits (or Losses) in the Law Firm. The latest book in the Financial Management Monograph Series. Designed to help firms identify profits (or lack thereof) by their source.

Improving Accounts Receivable Collection: A Practical System. Gives basics for developing formal billing and collection process. With easy-to-adapt collection letters, engagement letters, and LOTUS 1-2-3 templates to help analyze accounts receivable.

AJM 8279

Legal Fees and Representation Agreements. Includes easy to-use models for written client/lawyer and counsel/ associate counsel agreements.

Managing for Profit: Improving or Maintaining Your Bottom Line. Learn how to manage and improve profits while maintaining or improving work quality and client satisfaction.

Managing Partner 101: A Primer on Firm Leadership. Advice from the corner office that will help any new or aspiring manager. Written by a managing partner with practical suggestions, tips, and ground rules.

Marketing and Legal Ethics. Discusses the ethical limitations on the whole range of marketing activities. Extensive indexes to topics and specific cases.

Marketing Your Practice. A complete guide for planning, developing, and implementing a law firm marketing plan. Includes checklists, questionnaires, samples of brochures and newsletters, direct mail pieces.

Organizing Successful Client Seminars. Avoid disaster and last-minute panic attacks with the advice and guidelines in this publication.

Planning Workbook for Law Firm Management, second edition. Defines and reviews the benefits of long-range planning. Sample charts, questionnaires, and cassette included.

When Disaster Strikes. Will help you be prepared in the event of an unexpected disaster, such as earthquake, fire, tornado. With checklists, bibliography of helpful resources.

Writing Your Law Firm Newsletter. Get rules and guidance for writing a newsletter, including tips on graphics, time-tables, cost-benefit analysis. With sample newsletters created by other firms.

To order, complete the order form that follows and return to: American Bar Association, Order Fulfillment 511, 750 N. Lake Shore Dr., Chicago, IL 60611.

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Order Form

Qty	Title	LPM	Regular	Total
__	Art of Managing Support Staff (5110202)	$44.95	$52.95	____
__	Basics for Writing Your Brochure (5110223)	$14.95	$19.95	____
__	Beyond the Billable Hour (5110260)	$69.95	$79.95	____
__	Building Firm with Associates (5110254)	$29.95	$34.95	____
__	Compensation Plans (5110201)	$32.95	$36.95	____
__	Corp. Counsel Comp. Gd. (5110099)	$15.95	$24.95	____
__	Flying Solo (5110084)	$39.95	$49.95	____
__	Yellow Pads to Computers (5110289)	$64.95	$69.95	____
__	Identifying Profits (5110259)	$14.95	$19.95	____
__	Improving Receivable Collection (5110273)	$39.95	$49.95	____
__	Legal Fees & Agreements (5110074)	$14.95	$24.95	____
__	Managing for Profit (5110288)	$39.95	$49.95	____
__	Managing Partner 101 (5110272)	$19.95	$29.95	____
__	Marketing and Legal Ethics (5110280)	$32.95	$39.95	____
__	Marketing Your Practice (5110215)	$44.95	$54.95	____
__	Organizing Client Seminars (5110278)	$19.95	$29.95	____
__	Planning Wkbk for Firm Mngmt (5110092)	$99.95	$99.95	____
__	When Disaster Strikes (5110245)	$11.95	$16.95	____
__	Writing Law Firm Newsletter (5110216)	$14.95	$19.95	____

Handling Charge $ 3.95

TOTAL $____

____Check Enclosed ____MasterCard

Account Number Exp. Date

Signature

Name

Firm

Address

City State Zip

IMPORTANT: Phone number will speed your order:_____

Return to: ABA Order Fulfillment 511, 750 N. Lake Shore Dr., Chicago, IL 60611. If you need overnight delivery, call (312) 988-5555.

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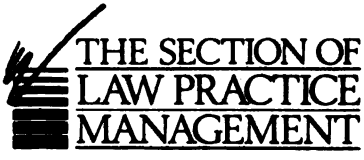

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Direct Broadcast Satellites

A Competitive Alternative to Cable Television?

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Supported by
The Markle Foundation
Richard S. Leghorn

RAND

PREFACE

This report is an economic and engineering analysis of direct broadcast satellites' prospects for competing with cable television systems in the United States. Although substantial funds have been invested—and lost—in DBS ventures, no domestic satellite designed specifically for direct broadcast to the home is yet operating. A key question is whether technological advances and market conditions will enable DBS systems to emerge as a widespread competitor to cable systems during the 1990s.

A preliminary version of this study was presented at the Eighteenth Annual Telecommunications Policy Research Conference, Airlie House, Virginia, October 2, 1990. This study is a companion to an earlier RAND report by Leland L. Johnson and David P. Reed, which examines telephone company prospects for competing with cable (*Residential Broadband Services by Telephone Companies? Technology, Economics, and Public Policy,* RAND, R-3906-MF/RL, June 1990).

This research was supported by grants from The Markle Foundation and from Richard S. Leghorn. Government legislative and regulatory bodies, telecommunications companies, consumer groups, and the academic research community may find it of particular interest.

SUMMARY

The purpose of this study is to explore direct broadcast satellites' potential for providing widespread competition to cable systems during the 1990s. We also examine, more briefly, other multichannel television alternatives to cable to assess the likelihood of competition from other directions. From this analysis we address a number of issues relating to public policy.

Today, cable television operators are the dominant providers of multichannel television services to American homes. After cable was essentially deregulated under the Cable Communications Policy Act of 1984, rates to subscribers rose rapidly and numerous complaints emerged about service quality. Consequently, many ask whether cable should be "reregulated" or whether competitive pressures will provide adequate safeguards.

The answer to this question rests, in part, on whether other multichannel systems will offer widespread competition to cable during the 1990s. These alternatives include (a) direct broadcast satellite (DBS) systems, which employ higher-power satellites than previously available to permit smaller, less-expensive earth receive terminals, (b) "second" cable systems that would compete alongside existing cable systems, (c) "wireless" cable that involves over-the-air transmission to subscribers in a certain microwave frequency band, (d) home satellite dish (HSD) or "backyard" receivers that pick up satellite signals intended for cable headends and broadcasting stations, and (e) satellite master antenna television (SMATV) systems that use cable to distribute satellite signals to multihousehold dwellings such as apartment buildings.

The use of satellites for broadcasting to the home attracted strong interest in the United States during the 1980s. But the decade was marked by failed ventures and postponed plans in part because the proposed systems had limited channel capacities, required use of relatively large and expensive receiving terminals at the home, and had restricted access to programming.

The situation is changing, however, because high-power satellites are now feasible, which enables use of small antennas for home receiving terminals. Moreover, digital video compression techniques are being developed which will increase dramatically the number of available television channels. Several companies plan to offer DBS service, including some with a good deal of expertise in the electronic media.

For our analysis, we construct a model satellite system whose characteristics we judge would give it the best chance to widely compete with cable. The system uses radio spectrum space allocations made by the Federal Communications Commission (FCC) to a single DBS orbital position. Under international agreement, the United States has been allocated eight satellite orbital positions, each with a capacity of 32 uncompressed conventional television channels for domestic high-power DBS use. The FCC has granted conditional construction permits for these transponder channels to eight companies. Once digital video compression techniques are successfully commercialized (a process occurring now), many more channels could be derived from these transponders.

We select a high-power satellite system (more than 200 watts per transponder) rather than a medium-power system (40 to 50 watts per transponder) because this higher power enables use of receiving antennas with diameters of one-half meter or less. This characteristic not only reduces receiver costs but widens public acceptability on aesthetic grounds. Although medium-power systems (examples of which are already in use) may nevertheless be profitable because of lower satellite costs, their obtrusive antennas, having diameters of one meter or more, are likely to be attractive largely to households not passed by cable.

Our model system has a capacity ranging from 32 television channels to as many as 256 channels if digital video compression techniques could be used to obtain an average of eight television channels per satellite transponder. We compare this system to a model cable system, described in an earlier RAND report, which includes optical fiber in trunk lines to increase reliability, quality of service, and channel capacity beyond those of today's cable systems.

From a comparative analysis of these models we conclude that, during the 1990s, high-power DBS systems have greater potential for widespread competition with cable systems than do other multichannel alternatives. DBS operators potentially would incur lower costs to enter and exit local markets than would second cable systems (including systems that might be owned by telephone companies if the cross-ownership ban between telephone and cable companies were lifted). This situation would render the threat of entry by DBS systems more credible, forcing existing cable operators to lower prices and improve service even in areas where few households subscribe to DBS service. Wireless cable has limited channel capacity and is handicapped by problems of ensuring line of sight from the receiving antennas to transmitters located on microwave towers. Use of existing HSD receivers will continue, but the market for new terminals would substantially diminish if low-cost, small-antenna DBS terminals became

available and the DBS programming were sufficiently attractive. SMATV systems would probably link into DBS systems to provide an ancillary means to distribute DBS signals.

However, whether DBS *will* compete widely with cable depends on a number of factors. Especially important are (a) the cost of small-antenna home receiving terminals, (b) operating expenses, including the costs of program acquisition, and (c) demand for the additional programming that could be provided by DBS systems.

The outcomes of our analysis are rather insensitive to the costs of satellites and rocket launches, because they are spread over millions of households. Of greater importance are the cost of user terminals and operating expenses. If per-subscriber operating expenses and service offerings were the same for DBS and cable systems, DBS systems would be widely competitive with modern, high-capacity cable systems only if the cost of user terminals were around $300 to $500. We expect that early DBS systems will cost perhaps twice that—from $600 to $1,000. Because of these higher costs, the market for such early systems will probably be confined largely to households that are not passed by cable.

Operating expenses of DBS systems, relative to cable, pose a major uncertainty because the technologies differ in so many ways. According to one small sample of cable systems, operating expenses, including program acquisition costs, amount to about 60 percent of revenues. Differences in these expenses between cable and DBS systems could greatly affect their competitive positions.

DBS's prospects for competing with cable in any geographic market will depend on the relative value to potential subscribers of the two services offered, and their relative prices. The potential for competition is uneven over the nation, depending on such factors as the number and quality of over-the-air signals and the cost and quality of cable offerings.

DBS systems may suffer a disadvantage in being able to carry few, if any, signals of local broadcasting stations. Working in the other direction is the possibility that DBS could carry many more signals with national and regional programming than would be transmitted by terrestrial means. Whether a significant market would exist for programs on these additional channels remains an open question.

High definition television (HDTV) could become an important market for DBS during the late 1990s. For terrestrial broadcast of HDTV, the FCC is now considering alternative transmission standards. After its decision, expected in 1993, HDTV receivers will be designed to be compatible with the chosen transmission standard. Local broadcasting stations will require costly retrofit for HDTV transmission, and

some cable systems will be less adaptable for HDTV use than others. For these reasons, cable systems and broadcasting stations will provide only a patchwork of HDTV coverage during its early years. In contrast, the conversion of only one DBS feeder uplink would permit instantaneous national coverage by satellite. Therefore, DBS systems have the potential of being the first nationwide distributors of HDTV programs.

Although the pace of technological advance is uncertain, it is likely to occur more rapidly in electronics than in other portions of telecommunications networks, as has been true in the past. This process will differentially benefit DBS systems, especially digital ones, because of their heavier reliance than cable on electronic components. If so, DBS systems will become progressively more attractive, relative to cable, over time.

Two conclusions of the study involve public policy issues whose resolution could significantly affect the future of DBS systems.

- The premiums for programs reportedly now paid by media that compete with cable would pose a significant burden for DBS systems. Whether program access is being used as an anticompetitive tool to hamper the growth of DBS is an important area for government investigation.
- Cable operators are likely to face heavy risks if they buy into DBS systems for the purpose of foreclosing competition with their cable systems. Nevertheless, crossownership is an important issue for investigation by the FCC, Congress, and the Department of Justice.

The study reaches four conclusions, relating to public policy, that would be relevant if widespread DBS growth *does* occur.

- Local commercial and local public broadcasting could be detrimentally affected, running contrary to the longstanding goal, pursued by the FCC, of promoting "localism" in broadcasting.
- DBS systems will improve program diversity to the extent that they expand viewers' access to existing programs and stimulate the production of additional ones—contributing to First Amendment goals.
- If competition between DBS and other media leaves DBS without monopoly power, the issue of common carrier compared with private carrier status for DBS would be of less concern than otherwise. Moreover, its functional similarity to other wireless systems and to cable systems would argue in favor of private carrier status.

- **Local franchise requirements for cable may need to be modified, and consideration should be given to establishing a market for radio spectrum use, to help ensure that competitive outcomes are economically efficient.**

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Any errors of fact and interpretation are the sole responsibility of the authors.

CONTENTS

PREFACE iii

SUMMARY v

ACKNOWLEDGMENTS xi

FIGURES AND TABLES xv

GLOSSARY xvii

Section

I. INTRODUCTION 1
The Role of Competition 1
Purpose, Methodology, and Organization of the Study 3

II. PAST DEVELOPMENTS AND FUTURE PLANS 5
Domestic Uses of Satellites for Television 5
Past DBS Ventures 9
What Has Changed? 10
Technological and Market Uncertainty 13

III. COMPETITION BETWEEN DBS AND CABLE SYSTEMS 15
DBS and Cable Models 15
Competition with Existing Cable Systems 27
DBS and Second Cable Systems 31
Differences in Services 34
Effects of Technological Advance 37

IV. OTHER MULTICHANNEL ALTERNATIVES TO CABLE 39
Wireless Cable 39
Home Satellite Dishes 44
Satellite Master Antenna Television Systems 44

V. AN OVERALL ASSESSMENT 46

VI. TECHNICAL CHARACTERISTICS OF DBS SYSTEMS 48
Orbital Positions and Frequency Assignments 48

Digital Video Compression 51
Signal Security 59

VII. PUBLIC POLICY ISSUES 64
Access to Programming 64
Crossownership 66
Effects on Local Broadcasting 70
Program Diversity 72
Common Carrier Compared with Private Carrier Status 74
Cable Franchise Obligations and Radio Spectrum Use . . 75

VIII. CONCLUSIONS 78

Appendix: DIGITIZING A VIDEO SIGNAL 83

BIBLIOGRAPHY 85

FIGURES

1. Antenna diameter needed to discriminate among satellites along geostationary orbital arc 7
2. Comparative annualized investment costs 23
3. Comparative annualized investment costs: alternative channel multiplication ratios 28
4. Illustration of wireless cable network 40
5. Elevation angles for pointing at a satellite located at 110 degrees West Longitude 42

TABLES

1. Conditional construction grants for DBS systems, early 1990 8
2. Investment cost estimates, model DBS system 17
3. Annualized investment cost, model DBS system 22
4. Cable operating expenses per subscriber, 1989 25
5. Comparison of model DBS to alternative systems 47

GLOSSARY

ACC	Advanced Communications Corporation
AM	Amplitude Modulation
BPSK	Biphase Shift Keying
BSB	British Satellite Broadcasting
BSS	Broadcast Satellite Service
CCITT	Consultative Committee on International Telephone and Telegraph
CLI	Compression Labs, Inc.
COMSAT	Communications Satellite Corporation
CONUS	Contiguous United States
DBS	Direct broadcast satellite
DCT	Discrete Cosine Transform
EIRP	Equivalent isotropic radiated power
ESS	European Satellite Society
FCC	Federal Communications Commission
FEC	Forward error correction
FSS	Fixed Satellite Service
HDTV	High definition television
HF	High Frequency
HSD	Home satellite dish
IPPV	Impulse pay-per-view
IRD	Integrated receiver-decoder
ISO	International Standards Organization
ITFS	Instructional Television Fixed Service
JPEG	Joint Photographic Experts Group
LHCP	Left-hand circularly polarized
LNB	Low noise block converter
MF	Medium Frequency
MMDS	Multichannel multipoint distribution system
MPEG	Motion Picture Experts Group
MSO	Multiple System Operator
NHK	Nippon Hoso Kyokai
NTSC	National Television Systems Committee
PM	Phase Modulation
PPV	Pay per view
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RARC	Regional Administrative Radio Conference

RHCP	Right-hand circularly polarized
SBC	Subband coding
SBCA	Satellite Broadcasting and Communications Association
SMATV	Satellite master antenna television
SMPTE	Society of Motion Picture and Television Engineers
TCI	Tele-Communications, Inc.
TVRO	Television receive-only
UHF	Ultra High Frequency
VHF	Very High Frequency
VLSI	Very large scale integrated
VSAT	Very small aperture terminal
VSB	Vestigial sideband
WARC	World Administrative Radio Conference
W.L.	West Longitude

I. INTRODUCTION

Many have expressed concern about whether competitive pressures are sufficient in the cable television industry to ensure reasonable prices and service quality to the American public. After cable was essentially deregulated under the Cable Communications Policy Act of 1984, rates to subscribers rose rapidly and numerous complaints emerged about service quality. Consequently, many ask whether cable should be "reregulated" or whether competitive pressures will provide adequate safeguards.[1]

THE ROLE OF COMPETITION

In accordance with provisions of the Cable Act, the Federal Communications Commission (FCC) forwarded to Congress the results of an extensive investigation of the industry. The Commission concludes that cable systems "do possess varying degrees of market power in local distribution."[2] The Commission rejects the notion of reregulation as a remedy, however, favoring instead the encouragement of competition.

> This Commission steadfastly believes that robust competition will more effectively provide both a better safeguard against undue rate increases or service failings and a greater diversity and choice than any web of rules and regulations designed to mimic competition or otherwise compensate for its absence.[3]

One way to encourage competition is to eliminate legal prohibitions on telephone company delivery of television services. In 1988, the FCC tentatively concluded that a policy of open entry by telephone companies, subject to safeguards against anticompetitive conduct, would serve the public interest.[4] However, as of this writing it has not made

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[1]As evidence of the limited degree of competition, many point to the high selling prices of existing cable systems (more than $2,000 per subscriber) relative to construction costs (in the neighborhood of $600 per subscriber). For contrary views about the validity of measuring market power by dividing the market value of the firm by the replacement costs of its assets (the "Tobin q") see Grossman (1990) and MacAvoy (1990). For an overall assessment see FCC (1990b), paras. 54–68.

[2]FCC (1990b), para. 69.

[3]FCC (1990b), para. 8.

[4]FCC (1988).

a final decision about whether to recommend to Congress that existing legislation, which generally prohibits crossownership, be modified.[5]

A recent RAND study concludes that, during the 1990s at least, lifting the restrictions on telephone company entry would lead neither to head-to-head, dual-network competition in the television market nor to emergence of new services.[6] This conclusion leaves open the question of whether other multichannel alternatives are likely to offer significant competition to cable. These alternatives include direct broadcast satellite (DBS) systems, "second" competitive cable systems, "wireless" cable systems, home satellite dish (HSD) terminals, and satellite master antenna television (SMATV) systems.[7]

DBS systems would employ higher-power satellites than previously available to permit smaller, less-expensive earth receiving terminals than are now in use. Second cable systems are those built alongside existing cable systems (called "overbuilding") for side-by-side competition. Wireless cable systems, also known as multichannel multipoint distribution systems (MMDS), have been allocated radio spectrum by the FCC to permit multichannel signals to be transmitted over the air from a tower to suitably equipped homes within line of sight of the tower. HSD terminals have relatively large antennas and households use them to pick up satellite signals intended for broadcasting stations and cable headends. SMATV systems receive satellite signals from an HSD-like terminal but then use cable to distribute the signals among clusters of dwelling units, such as apartment buildings.[8]

The FCC notes that "if provided reasonable access to cable programming services, wireless cable, second competitive cable systems, and SMATV operators have the potential to provide significant competition to cable."[9] Most notably for our purposes, the FCC goes on to say that "DBS has the potential, in our judgment, to become a strong competitor by the mid-1990s if recently announced plans go forward and DBS can obtain reasonable access to programming."[10]

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[5]The Cable Act codified the crossownership prohibitions adopted by the FCC in 1970. For a detailed discussion of these and other restrictions on telephone company delivery of cable television services, see Pepper (1988).

[6]Johnson and Reed (1990).

[7]The term "HSD" terminal is synonymous with the commonly used term "TVRO" (television receive-only) terminal, when the TVRO terminal is for household use.

[8]In addition to multichannel systems, cable has other sources of competition, such as over-the-air broadcasting and videocassettes. Consideration of their future potential is beyond the scope of this study.

[9]FCC (1990b), para. 13.

[10]Ibid.

PURPOSE, METHODOLOGY, AND ORGANIZATION OF THE STUDY

As a companion to the earlier RAND analysis, this study explores DBS's potential to provide "widespread" competition with cable systems during the 1990s and, hence, to alleviate the need for extensive reregulation of cable. We regard competition as widespread if the availability of DBS services induces cable operators to cut prices and (or) improve services so that their total revenues are no greater than costs, including "normal" profits. (Of course, some competitive firms, unable to cover costs, will disappear.)

To pursue this study goal, we examine the relevant technologies, some implications of the technological advances that can reasonably be foreseen, and the comparative costs of DBS and cable systems. We also consider the prospects for second cable, wireless cable, SMATV, and HSD systems as alternatives to DBS systems to assess whether they hold more promise than DBS as competitors to cable. We then address a number of public policy issues, such as the effects on local broadcasting, the question of whether cable operators should be permitted to buy into DBS systems, and the problems posed by access to programming.

In pursuing these tasks, the study involves a methodology with several elements.

- Review of the relevant literature, cited throughout.
- Interviews with knowledgeable individuals in satellite and related fields.
- Comparison of the economic and technical characteristics of a model DBS system, which we construct, with those of a model high-capacity cable network drawn from a previous RAND study.
- Use of sensitivity analysis to examine the effects of alternative assumptions and quantitative estimates.
- Explanations of our estimates in sufficient detail to enable readers to easily replicate the results.

In light of the many uncertainties about costs and market conditions, an important contribution of this study is our analytic framework with which readers may assess the consequences of introducing their own assumptions and other inputs.

The study is organized as follows. Section II describes briefly the use of satellites for television delivery, the history of DBS ventures, and the technological and market conditions that make DBS applications more attractive now than in the past.

Section III focuses on the potential for DBS competition with cable systems. It compares our hypothesized model DBS system to a model cable system, examines how differences in services affect the comparisons, and assesses the role of continuing technological advance.

Section IV considers three alternatives to both DBS and cable systems—wireless cable, HSD, and SMATV systems, and Sec. V briefly assesses the alternatives treated in Secs. III and IV.

Section VI explores in more detail three technical factors central to the viability of DBS systems: the orbital and channel assignments for high-power DBS satellites, the impact of digital video compression proposed for use by some systems, and the ways that signal security, necessary to prevent unauthorized viewing, may differ between DBS and cable systems.

Section VII discusses six public policy issues related to competition between DBS and cable systems. Resolution of the first two could significantly affect the future of DBS—DBS systems' access to programming, and crossownership between DBS and cable systems. The other four become relevant if DBS *does* become a widespread competitor to cable—effects on local broadcasting stations, effects on program diversity, common carrier compared with private carrier status for DBS systems, and cable franchise requirements.

Section VIII brings together major conclusions.

II. PAST DEVELOPMENTS AND FUTURE PLANS

To provide background for the subsequent discussion, in this section we briefly discuss the current uses of satellites for television transmission, including the nature of radio frequency assignments. We note past DBS ventures and suggest reasons why they failed. We conclude by discussing why DBS applications are more promising today and describe several recently announced proposals for DBS service.

DOMESTIC USES OF SATELLITES FOR TELEVISION

Domestic uses of satellites for television are primarily for transmission to and from broadcasting stations, and transmission from program sources to the headends of cable systems. The use of satellites by cable systems permits low-cost networking of the hundreds of cable systems in the United States, thus promoting the widespread growth of pay channel services (such as HBO and Cinemax) and basic cable network services (such as C-Span, CNN, and USA). Without satellites, cable operators would have been severely handicapped in offering the vast array of programming now available over dozens of channels.

With these applications came an unanticipated development: the emergence of "backyard" HSD terminals. By the end of the 1970s, the cost of TVRO terminals for cable headends had fallen to the point where they became within reach of individual households. The antennas were big (over two meters in diameter) and cost between $2,000 and $3,000. But the investment was attractive because it permitted the user to tune into the multitude of signals beamed to cable headends and broadcasting stations—without any payment for the programs. What began as a piggyback phenomenon, amounting to 5,000 HSD terminals in place in 1980, grew rapidly to cumulative sales of more than three million terminals by mid-1990.[1] Signal scrambling was introduced in 1986, and procedures were later devised to require HSD terminal users to pay for these signals.[2] The institution of payment has

[1] As of July 1, 1990, 3,075,500 total units had been shipped ("Monthly Satellite Systems Shipment Update," *Sat Vision*, Satellite Broadcasting and Communications Association (SBCA), September 1990, p. 27).

[2] According to recent count, over 75 signals available to HSD users were unscrambled and more than 30 were scrambled. Not surprisingly, scrambled signals include pay channels and many of the most popular basic cable network services (National Cable Television Association, 1989, p. 3, and unpublished data).

slowed, but failed to halt the growth of HSD sales, because of (a) access to many dozens of television channels, in addition to those carried by local cable systems, (b) the lack of cable service to some 10 million households,[3] and (c) the pirating of scrambled signals enabled by illegal use of decoding schemes.

Most of the above uses are within the C-band radio frequencies allocated by the FCC for "fixed satellite service" (FSS). In addition, the FSS includes a set of higher frequencies in the Ku-band. The Ku-band is especially attractive for DBS use because it permits smaller receiving antennas than those needed at C-band frequencies (at the expense, however, of greater susceptibility to rain fade). Antenna size is dictated by two considerations: (a) the distance along the geostationary orbital arc among satellites that share the same radio frequencies, and (b) the power density from the satellite at the ground (measured in watts per square meter). With respect to the first, the antenna must be large enough to discriminate among adjacent satellites. One handicap in using the FSS bands is that the spacing among satellites along the orbital arc is only two degrees. The antenna size required to discriminate among satellites would be smaller if satellite spacing were widened. As shown in Fig. 1, for a given spacing among satellites, the minimum antenna size needed for satisfactory discrimination is smaller at the Ku-band than at the C-band frequencies.[4]

Wider satellite spacing has been a key factor in decisions about the allocation of radio spectrum for DBS services. In the early 1980s, in response to the urgings of those seeking to offer domestic DBS services, the FCC allocated additional spectrum within a portion of the Ku-band known as the Broadcast-Satellite Service (BSS) band. In accordance with international agreements, eight U.S. orbital positions were established with each using the full BSS band. Most notably, the minimum satellite spacing was set at nine degrees, in contrast to the two degree spacing in the FSS Ku-band. Each orbital position was designated to have 32 transponder channels and 24 MHz bandwidth

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[3]Of the nation's 91 million TV households in early 1990, more than 81 million were passed by cable, and about 50 million subscribed (data from Paul Kagan Associates, Inc., as reported by National Cable Television Association, 1990, p. 1).

[4]For operation within a given frequency band, the smaller the antenna, the wider its beam. For this reason the minimum antenna diameter allowed is inversely related to the spacing of satellites that operate in the same frequency band. Operation at C-band requires a larger antenna to get the same size beam as at Ku-band frequencies because of the longer wavelengths of the C-band frequencies. In the United States, satellites in the FSS Ku-band are commonly used today for a variety of business services with "very small aperture (antenna)" terminals (VSATs).

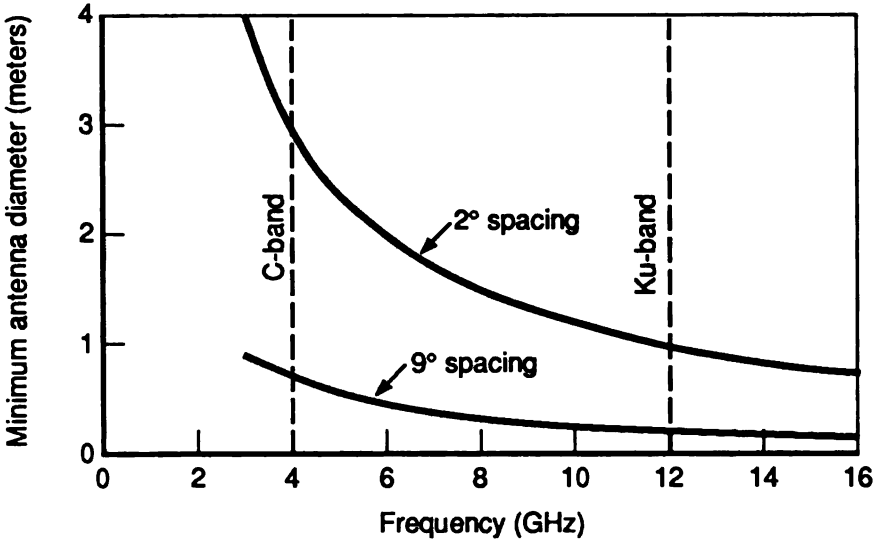

Fig. 1—Antenna diameter needed to discriminate among satellites along geostationary orbital arc

per transponder.[5] Three of these positions enable full coverage of the contiguous United States (CONUS). The others cover either the eastern or western portions of the United States. To permit reuse of spectrum space from each orbital position, orthogonal polarization is used, with 16 transponder channels on one polarization and 16 on the other, as discussed in Sec. VI.

To take advantage of wider orbital spacing requires that satellite power be increased, since the smaller the receiving antenna, the greater must be the satellite power. When used with "high-power" (in the neighborhood of 200 watts per transponder) satellites, the minimum spacing of nine degrees between U.S. satellites operating in the BSS Ku-band permits use of antennas of about a half meter in diameter or less. In contrast, the two degree spacing of satellites in the FSS Ku-band requires antennas of about one meter in diameter or more. With only two degree spacing, the added power of a high-power satellite would be "wasted" because the smaller antenna that the satellite's

[5]All FCC decisions about radio spectrum use must be consistent with international agreements, treated briefly in Sec. VI.

power would permit could not be used because the antenna could not discriminate among satellites spaced so closely together. Consequently, DBS service in the FSS Ku-band is attractive only when limited to "medium-power" (in the neighborhood of 50 watts per transponder) satellites.

The distinction between medium- and high-power satellites is of key importance because high-power satellites operating in the BSS band, used with smaller antennas on the ground, are stronger candidates for widespread competition with cable, as analyzed in detail in Sec. III.[6]

Several organizations have been conditionally granted transponder channel positions in the BSS band, as shown in Table 1.[7] The

Table 1

CONDITIONAL CONSTRUCTION GRANTS FOR DBS SYSTEMS, EARLY 1990

Grantee	Channel Pairs
Advanced Communications Corp.	27
Continental Satellitee Corp.	11
Direct Broadcast Satellite Corp.	11
Directsat Corp.	11
Dominion Video Satellite	8
EchoStar Satellite Corp.	11
Hughes Communications Inc.	27
United States Satellite Broadcasting	8

SOURCE: *Broadcasting*, February 26, 1990, pp. 30–31.

NOTE: Eleven channel pairs are being held on reserve for DBS applicant Tempo Development Corporation, principally owned by Tele-Communications, Inc. (TCI), the largest cable multiple system operator (MSO) in the United States.

[6]Medium-power systems have an advantage of lower space segment costs and may be profitable in serving limited markets. However, to be widely competitive with cable, such systems would likely require greater market penetration, as we discuss in Sec. III.

[7]A "channel pair," shown in Table 1, consists of one transponder channel at one of the four eastern satellite locations and one at one of the four western satellite locations. Thus, all grantees can provide full CONUS coverage with their channel pairs. Grantees in the three locations that have full CONUS coverage noted above (three of the eastern locations) could cover the full CONUS from these locations, if they choose, without using their assignments in the western locations. Thus, the orbital locations of channel pairs are not equally valuable and, therefore, may affect the relative competitive positions of the grantees (see Sec. VI, footnote 2). These assignments were made in accordance with the FCC's evaluation of the merits of applications from potential DBS operators. A critique of this process of allocating rights to radio spectrum use lies beyond the scope of this study.

permittees are in various stages of planning and constructing their systems within a highly uncertain market for DBS services. To develop a new electronic medium in the face of a mature and strong cable industry will not be easy. Moreover, many households not served by cable already have HSD terminals. Technological uncertainties, including the design and cost of DBS user terminals, further cloud the picture. Reflecting this situation is a history of failure in the DBS field.

PAST DBS VENTURES

The landscape is littered with the wreckage of DBS ventures. Perhaps the most notable was COMSAT's effort, which was started in 1979 and abandoned in 1984—but only after COMSAT had ordered two three-transponder satellites from RCA.[8] However, today's prospective DBS operators have benefited, for it was COMSAT in the early 1980s that "persuaded the FCC to set aside spectrum for DBS and establish regulations for the medium over the strenuous objections of the broadcasting industry."[9]

Other examples during the 1980s include (a) the United Satellite Communications, Inc., venture in which the Prudential Insurance Company reportedly lost nearly $70 million, (b) Skyband, Inc., which lasted only a few months and lost some $12 million, and (c) Crimson Satellite Associates that, after planning service on the Ku-band Satcom K-3, sold the satellite at a loss to a Luxembourg-based satellite broadcaster.[10]

Three factors help to explain these failures. First, the user antennas were large (compared to those of some DBS systems being planned today), hence expensive and obtrusive. Second, only a few channels were to be offered by these systems.[11] These two factors made the basic economics of the systems questionable in light of the rapid growth of cable with which DBS would have to compete. Thus, the market would have been limited primarily to households in sparsely populated areas without cable. Third, the early proponents complained of difficulties in obtaining programming. High system costs, arising from the factors noted above, reduced companies' leeway to bid enough

[8]COMSAT reported losses of $25 million and $120 million in 1984 and 1985, respectively, as a consequence of its DBS venture. The $120 million figure amounted to 26 percent of COMSAT's total operating revenues for 1985 and was the dominant factor in its net loss of nearly $42 million reported for that year (COMSAT, 1985, p. 4).

[9]*Broadcasting*, February 26, 1990, p. 32.

[10]Ibid.

[11]COMSAT's plans called for three satellites, each with the capacity to carry three television channels.

for attractive programming. The problem was exacerbated because this new medium was attempting to break into the market without the benefit of scale economies afforded by a large subscriber base. The issue of program availability—which remains of critical importance—is treated in Sec. VII.

WHAT HAS CHANGED?

An obvious question is what technological and other changes are occurring that render DBS more promising than was the case during the 1980s? What reason do we have to believe that the current array of prospective DBS ventures will not merely add more litter to the landscape? Although the future may well see more failures, two technical advances brighten the prospects for DBS systems.

First, higher-power satellites using the nine degree spacing in the BSS spectrum allocations will permit smaller user antennas. This will reduce costs of manufacturing, handling, transport, and installation of the antennas and will enhance their aesthetic acceptability.[12] Second, digital video compression techniques could dramatically expand the number of conventional (NTSC) channels available from current satellite frequency allocations.[13]

Several groups announced plans during 1990 for DBS systems. One already being field-tested is "PrimeStar" backed by K Prime Partners, which includes as participants GE Americom, Tele-Communications, Inc., Warner Cable, American Television & Communications, Cox Cable, Newhouse Broadcasting, Viacom, United Artists, Continental Cablevision, and Comcast. The group has leased 10 transponders on a medium-power satellite (Satcom K1) to provide DBS service in the FSS Ku-band. The system incorporates analog instead of digital transmission and does not incorporate compression techniques to multiply the number of channels. Thus, the 10 satellite transponder channels correspond to 10 NTSC channels. This system will not

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[12]Aesthetics is a factor not to be discounted. One author of this report points out that antennas as large as three feet in diameter would be prohibited by his condominium association. Some communities restrict or prohibit the use of HSD antennas (see FCC, 1990b, para. 135).

[13]Until the advent of digital video compression, the term "channel"—formerly equivalent to "transponder" in reference to satellite transmission of television—has become ambiguous. In this study, we use the term "transponder channel" to indicate one frequency-assigned transponder bandwidth (e.g., 32 transponder-channels per DBS orbital position) and "channel" to indicate one NTSC television signal. NTSC stands for the National Television Systems Committee. This committee of industry representatives agreed to the "NTSC" standard for black and white broadcast television in 1940 and for color television in the early 1950s.

incorporate the technological advances noted above. However, according to one company representative, "K Prime will adopt a video compression scheme by spring 1991 and implement it by early 1992, expanding its channel capacity . . . by a factor of four, eight or more."[14] As of late 1990 the initial service, consisting of seven superstations and three pay-per-view channels, is being offered to homes in scattered test markets. Antenna diameters range from three to six feet—dictated by the power of Satcom K1 and the two degree orbital spacing in the FSS band.[15]

A second venture, SkyPix, has been formed by principals of Starscan Partnership. Similar to PrimeStar, the approach involves leasing 10 transponders on a medium-power satellite (SBS-6) operating in the FSS Ku-band. However, SkyPix advertises that it will use digital video compression techniques to provide 80 channels (an 8:1 channel multiplication) for DBS service planned for 1991.[16]

A third venture, the proposed Sky Cable system, includes as participants NBC, Hughes Communications, News Corporation, and Cablevision Systems.[17] Rather than calling for medium-power satellites operating in the FSS band, this proposal calls for a high-power satellite (the Hughes HS601) operating in the BSS band (in contrast to use of the FSS band by PrimeStar and SkyPix).[18] The more powerful satellite will permit a DBS receive antenna with a diameter of about a half meter or less—much smaller than the antennas for PrimeStar and SkyPix. The Sky Cable participants initially announced that their system of 27 transponder channels would translate to 108 NTSC channels (a 4:1 channel multiplication), but it now appears likely that an even higher channel multiplication will be obtained.[19]

Other organizations listed in Table 1 are also proceeding with plans for operations in the BSS band. For example, Advanced Communications Corporation (ACC) has announced plans for two 16-transponder

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[14]*Broadcasting*, October 29, 1990, p. 29

[15]Ibid., pp. 29–30.

[16]"Moving Up the Timetable on DBS," *Broadcasting*, August 20, 1990, p. 27. See also *Communications Daily*, August 15, 1990, pp. 1–2.

[17]Paul Richter, "New Satellite-to-Home TV Service Due in 1993," *The Los Angeles Times*, Part A, p. 1, February 22, 1990.

[18]The satellite can provide an equivalent isotropic radiated power (EIRP) of 53–54 dBW on a full-CONUS beam (interview with Andrew Strodtbeck, Hughes Aircraft Company, August 16, 1990).

[19]The initial estimate of 108 channels has been roughly doubled to about 200 channels, as reported by James Ramo, Panel Discussion, SBCA Convention, Nashville, Tennessee, July 9, 1990. If the DigiCipher system were used as advertised, this number could conceivably be as high as 270 NTSC-compatible channels. See Sec. VI for a discussion of how many compressed channels with acceptable reception to viewers can be transmitted through one transponder of a high-power DBS system.

high-power satellites to be procured from General Electric. Like Sky Cable's approach, ACC will use digital transmission and video compression, with satellite launches scheduled for 1993 and 1994.[20]

Finally, experiences in the United States and other countries illustrate the potential early uses of DBS. As noted above, over three million U.S. households own HSD terminals that cost $2,000 to $3,000 each. With user terminals estimated at only a fraction of that cost, as discussed in Sec. III, subscribership might expand far beyond HSD levels.

DBS systems are operating in Japan, the United Kingdom, and Western Europe. For example, a Japanese satellite, launched in mid-1990, has three channels for DBS service. The public broadcasting organization, Nippon Hoso Kyokai (NHK), uses two channels, one of which regularly carries HDTV programs.[21] The third channel is operated by Japan Satellite Broadcasting—that country's first private, satellite-based television service. Japan's system, which started in 1988 with a two-channel satellite, has a subscribership of about 2.6 million.[22] In the United Kingdom, Sky Television, started in early 1989 with a four-channel satellite, has about one million subscribers. British Satellite Broadcasting, started in 1990 with a five-channel satellite, has over 100,000 subscribers.[23] The European Satellite Society (ESS), operating a spacecraft launched in late 1988, has more than 1.5 million subscribers.[24]

For our purposes, the foreign experiences are useful mainly in providing user terminal cost data, treated in Sec. III. They are less relevant for estimating the potential growth of DBS systems in the United States, primarily because DBS systems face less competition from cable abroad than in the United States. In comparison with about 57 percent of U.S. television households that subscribe to cable, the figure is 3 percent for the United Kingdom, 2 percent for France,

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[20]*Communications Daily*, November 14, 1990, p. 3.

[21]For a history of the development of satellite-based HDTV in Japan, see Johnson (1990).

[22]*Space News*, December 16, 1990, p. 2.

[23]*New York Times*, November 3, 1990, pp. 2, 32. In the United Kingdom, a planned merger of British Satellite Broadcasting (BSB) and Sky Television was announced in late 1990. According to one report, the two firms had lost more than $1.5 billion before that time. The difficulties encountered in the United Kingdom may stem, at least in part, from the limited capacities of the systems and a television market too small to support two competing DBS systems.

[24]*Space News*, December 16, 1990, p. 2. The size of these countries enables the satellite power to be concentrated over a smaller area, allowing small user antennas without the corresponding need for a higher-power satellite as would be required for CONUS coverage. (All currently operating foreign DBS systems use analog transmission and have fewer than a half-dozen channels.)

26 percent for (West) Germany, and 23 percent for Austria. (For a few small countries—Belgium, The Netherlands, Luxembourg, and Switzerland—the subscriber percentages are higher than for the United States.)[25] For Japan, good data are not available, but somewhere between two million and six million homes are passed by cable, out of about 32 million television households—a cable availability level of less than 20 percent, compared to 90 percent in the United States.[26]

TECHNOLOGICAL AND MARKET UNCERTAINTY

The previous description is not intended to imply that the systems planned for the United States will be built as proposed. A good deal of uncertainty exists, as one would expect in any area of rapidly advancing technology and unclear markets. It would come as little surprise if new partnerships emerge, old ones collapse, and advertised future dates for service slip by months or years. For example, it has been reported that the four partners in the Sky Cable venture are having great difficulties in agreeing to form the company, despite the earlier signing of a memorandum of understanding. However, a Hughes spokesperson has emphasized that Hughes "is still as committed as ever to high powered DBS. We have every intention of fulfilling our [FCC DBS] license."[27]

The success of these ventures will depend greatly on the timetable for successful development of digital video compression. As discussed in Sec. VI, several approaches to digital video compression are being pursued. The key uncertainty relates to which approach or approaches will be most attractive in view of the tradeoffs among cost, time required for implementation, and the degree of compression attainable with acceptable reception quality.

Of course, technological advances and market growth are affecting alternatives to DBS as well. Especially important, cable operators are beginning to install fiber optics in their trunk lines to improve service, reduce maintenance, and expand channel capacity. Moreover, they are exploring the possibilities of using digital transmission and video compression, as discussed in Sec. III. In addition, the number of homes not passed by cable—the prime candidates for early DBS service—has shrunk dramatically, from about 18 million households in 1984 to 10 million in 1990.[28] How rapidly cable continues to move into

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[25]National Cable Television Association (1991).

[26]*Multichannel News*, May 21, 1990, p. 129.

[27]*Satellite Business News*, December 12, 1990, p. 1.

[28]National Cable Television Association (1984, 1990). Because about 42 percent of the nation's HSD terminals are used by households that are passed by cable (*Satellite TV*

previously unserved areas and how much investment will be directed to new cable technologies remain to be seen.

In this study we attempt to identify and evaluate these uncertainties. Consequently, our purpose is not to determine *whether* DBS systems will offer widespread competition to cable during the 1990s, but rather to explore the *conditions* under which they would offer widespread competition (while taking into account the potential role of other multichannel systems) and to trace the implications for public policy.

Week, September 20, 1989), one might conclude that HSD subscribership is nearly as attractive in cable areas as in noncable areas. However, one must remember that about 90 percent of all homes are passed by cable. Thus, the percentage of homes with HSD terminals in noncable areas is 12 times greater than the percentage in cable areas. These data suggest that although a large percentage of DBS subscribers will be located in cable areas, households in noncable areas will be much more likely to subscribe.

III. COMPETITION BETWEEN DBS AND CABLE SYSTEMS

In this section we compare DBS systems, existing cable systems, and second cable systems that might enter the market against incumbent cable operators. To simplify the analysis, we initially assume that services provided by DBS and cable systems are identical. Below we consider how differences in services, as well as technological advances, could affect their competitive positions. In Sec. IV, we expand the comparisons to include wireless cable, HSD, and SMATV systems. Section V provides an overall assessment of these multichannel alternatives to cable.

DBS AND CABLE MODELS

We compare the costs and other characteristics of a model high-power DBS system and advanced cable networks, which may be available in the mid to late 1990s. In addition to digital transmission and video compression for DBS systems, we must take into account a key technological advance available to cable systems—the use of optical fiber. We assume that during the same time period many existing cable systems will have been retrofitted with substantial amounts of fiber, while new ones (including second cable networks) will be of hybrid copper/fiber design similar to that described by Johnson and Reed (1990).

Our postulated model DBS system uses current radio spectrum space currently allocated to the BSS band. The characteristics of the model are chosen to reflect a combination of feasible technologies that would give DBS systems the best competitive position against cable, as discussed in detail below. Our system has the following features.

- It uses one of the DBS orbital positions that permits full coverage of the CONUS.
- Four satellites, each with eight transponders, are located at that orbital position.
- Each transponder has a power of 240 watts and a bandwidth of 24 MHz.
- One feeder link (uplink) station transmits to the four satellites.
- The system incorporates digital transmission and video compression.

With this configuration, the number of NTSC television channels transmitted through our model DBS system would range from 32 (i.e., one NTSC television signal per transponder) to 256 if digital video compression techniques are used to obtain eight NTSC television channels per transponder, or even more, as discussed in Sec. VI.

Especially important, we select a high-power rather than a medium-power satellite for our model system, because antenna diameters would be smaller (one-half meter or less) than those associated with medium-power satellites. This decrease in antenna size would reduce user receiver costs, widen public acceptability and, hence, strengthen DBS's competitive potential against cable. Although we cannot quantify in dollars the aesthetic value of reducing antenna size, *any* outdoor antenna imposes a handicap on DBS systems relative to cable. Thus, the smaller the antenna, the brighter are the prospects for DBS as a competitive alternative to cable.

On the other side, high-power satellites are more costly.[1] However, our analysis below shows that, for subscriber levels in the millions, space segment costs are a small part of total cost. Much more important are the costs of the receive terminals.

In considering the merits of high-power and medium-power systems, we must distinguish between the prospects for system profitability and the potential for widespread competition against cable systems. With sufficiently low space segment costs, even a few hundred thousand subscribers may enable a medium-power system to break even, especially if it does not face competition with a high-power system.[2] Despite more expensive receive terminals and larger antennas, a medium-power system may be able to attract enough subscribers—drawn largely from households not passed by cable—to be profitable, yet without posing a widespread threat to cable systems. In contrast, we are concerned in this study with the conditions under which a DBS system *would* pose a widespread threat. For that reason we postulate use of a high-power system.

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[1]For example, the Satcom K1 satellite has 16 (45 watt) transponders of which 10 are being leased to PrimeStar, and the SBS-6 has 19 (41 watt) transponders, 10 of which are planned for use by SkyPix. In contrast, a single satellite in our model system is limited to a total of only eight transponders because of the higher power (240 watts per transponder) that we postulate.

[2]PrimeStar is estimated to break even with 300,000 subscribers by 1993 (*Broadcasting*, October 29, 1990, p. 29).

Investment Cost

The Space Segment and Feeder Link. In our model, full use of the 32 channels allocated for an orbital position is met by four eight-transponder satellites. We estimate that each satellite costs $80 million, each launch $70 million, and other costs as shown in Table 2. These and other figures in Table 2 are stated in real terms with a base time period of 1989–1990.

Our estimated satellite procurement and launch costs are based on experience with a Navy UHF satellite program. The cost of each Navy satellite (which is based on the same Hughes HS 601 bus planned for use by the proposed Sky Cable venture) is estimated at about $60 million for a 10-satellite procurement.[3] Because of the smaller procurement in our model system, we estimate a higher satellite cost than the $60 million figure. The DBS high-power payload development costs (fixed costs) in our model would be spread over five rather than 10 satellites. Moreover, the smaller procurement would benefit less from the learning-curve effect—a decrease in unit cost that generally accompanies an increase in units produced. For these reasons, we postulate a *one-third* increase in unit cost, totaling $80 million per satellite.

The average launch cost for the Navy's system, using Atlas I rockets, is reported to be about $70 million, with the price being higher for

Table 2

INVESTMENT COST ESTIMATES, MODEL DBS SYSTEM
(In dollars)

Segment	Unit Cost	Total Cost	Comments
Space			
Satellites	80 million	400 million	Four plus one ground spare
Launch	70 million	280 million	Based on Atlas IIa or Ariane 4 vehicle
Insurance	30 million	120 million	20 percent of cost of four satellites and four launches
Earth			
Feeder link (uplink) and business center	150 million	150 million	—
User terminal	300–800	—	Includes installation
Total		950 million	

[3] "Navy Likely to Add New Capability to UHF Follow-On Communications Satellites," *Aviation Week and Space Technology*, June 4, 1990, p. 4.

an Atlas IIa launch.[4] However, since the DBS satellite is not limited to U.S. launch providers, price competition between Ariane 4 and Atlas IIa will likely put downward pressure on launch costs. Therefore, we adopt the $70 million launch figure. The 20 percent insurance figure[5] amounts to a total of $120 million for the launch of four satellites.

From the above, the total estimated space segment cost is $800 million. If we assume one feeder link station and business center at an additional $150 million, the total cost (excluding user ground terminals) would approach $1 billion.[6]

Obviously, these figures are very rough. But precision here is not vital. As demonstrated below, the cost of the space segment and feeder link station will not greatly affect the relative competitive positions of DBS and cable systems. Of greater importance will be the cost of user terminals and operating expenses.

User Terminals. The configuration of a DBS ground terminal will be similar in many ways to an HSD terminal used in the FSS C-band. In both, the outdoor units consist of the antenna, feed, low-noise block converter (LNB), and cabling into the dwelling. In addition, HSD outdoor units generally include a polarizor to change polarizations and a positioner to move from one satellite to another.[7] The similarity between the two systems will end with the indoor unit—the integrated receiver-decoder (IRD).

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[4]Ibid.

[5]The 20 percent insurance figure is taken from the cost analysis in "Shopping for a Launch Vehicle," *Uplink*, Hughes Communications, Winter 1989, p. 6.

[6]The cost of the feeder link station is especially hard to estimate because of the proprietary nature of this information for planned and operating DBS systems. In a telephone interview, Daniel Garner of Advanced Communications Corporation (ACC) (listed in Table 1) estimates the cost at $50 million to $75 million. We take a higher estimate in our model to allow for growth in channel capacity (depending on digital video compression ratios that become economically attractive and for construction of a business center). Fortunately, the outcomes of our analysis are quite insensitive to estimates of this cost component. The DBS terrestrial infrastructure would also include television studios and postproduction facilities, tape playback facilities, transmission links to the uplink site, conditional access management centers, and customer service centers. These facilities, however, are similar to those that constitute a cable system's terrestrial infrastructure and hence are not included in our comparative analysis.

[7]As with HSD systems, if the DBS system uses both polarizations, the receiver would select either one polarization or the other for viewing at any given time. This would require a polarizor at the antenna feed to switch from one polarization to another. Any additional television sets in the house would be "slaved" to the polarization selected by the master set. One way to avoid this inconvenience—also faced by HSD owners—is to simultaneously bring both polarizations into the home. This would require a dual-polarization LNB (which would, in effect, convert what had been polarization multiplexing to frequency multiplexing, so that the single LNB output would have twice the bandwidth and all the channels available simultaneously), along with cabling and an integrated receiver-decoder (IRD) equipped to accommodate a 1 GHz (rather than a 500 MHz) bandwidth.

The HSD indoor units originally consisted of (a) a receiver to tune in the selected channel in the intermediate frequency (IF) band (950–1450 MHz), demodulate the signal, and reformat it into an NTSC signal in the VHF band; and (b) a controller to reposition the dish from one satellite to another. Around 1985 these two units were integrated into one box. After scrambling of some cable programming began in early 1986, HSD owners had to buy the VideoCipher II (VCII) decoder (descrambler) unit to view the descrambled programming. As the HSD market matured, the VCII module was also integrated into the receiver box, which became known as the integrated receiver-decoder (IRD).

Our model DBS indoor units, in contrast, must handle compressed digitized video signals that must be digitally processed before being converted to an analog NTSC format. These DBS indoor units will consist of a receiver to tune in the desired transponder, a decoder (which in this case performs forward error correction decoding rather than descrambling), a demultiplexer to select the desired channel within the transponder, a descrambler, a decompressor, and finally a digital-to-analog NTSC converter. For aesthetic and other reasons the indoor units will be combined into one unit, in what will probably still be called the IRD.

It is important to emphasize one handicap posed by the use of digital video compression—whether used by DBS, wireless cable, or other systems. The output of the digital-based IRD described here is designed for one television set, tuned to one channel at a time. Each additional set in the household will require its own IRD if it is to demodulate, demultiplex, and decompress a different channel than that being viewed on the master set. Likewise, an additional IRD would be needed if the viewer wanted to videotape one program while simultaneously watching another. This is one reason why the cost of the IRD is so important. If the cost of multiple IRDs is high, households that enjoy watching a "lot" of television—evidenced by multiple TV receivers, a VCR, and such—would find DBS service less attractive than otherwise. At the same time, such households may be the prime market for multichannel systems. If so, an analog cable system (with no video compression), which can easily deliver different programs to be watched simultaneously in the home, would have an advantage over systems with digital video compression in appealing to this market.

In estimating the costs for the DBS ground terminal two considerations are paramount.

- Although the *configuration* of the outdoor units will be similar to that of HSD units, the overall cost of the outdoor units will

be much less because the DBS antenna will be smaller, resulting in substantial savings. (The LNB would be the same, except for a small offset in frequency, as existing Ku-band units.)

- The biggest single difference in unit cost will be the cost of the IRD. The extensive digital processing and signal access control will result in high initial costs for the IRD (hence, high overall terminal costs), which will drop over time.

Cost figures from the DBS market in Japan and the United Kingdom are useful, because their DBS terminals have similar technical characteristics to terminals proposed for DBS services in the United States. The foreign DBS terminals typically include the antenna, LNB, and FM receiver and descrambler (IRD). As of August 1990 in Japan, the advertised retail price (not including installation) for a DBS terminal with a 45 cm antenna diameter and no descrambler was $640. In the United Kingdom, the retail price for Sky Television's DBS terminal, which has a 60 cm diameter antenna, was $610, and the BSB terminal cost $690.

Because its D-MAC system has processing and signal security requirements that most closely approximate the characteristics of our model system, we conclude that the BSB terminal cost of $690 provides the best baseline for estimating the costs of an advanced system in the United States.[8] Our model system incorporates digital transmission and video compression, at additional cost. Working in the other direction are economies of large-scale production if DBS systems enjoy substantial penetration in the U.S. market. For these reasons, we use $800 as an upper bound, as shown in Table 2, for large-scale production. (The costs of early units could be substantially higher.) For a lower bound we use $300, which was the level initially proposed by Sky Cable for its user terminals.[9]

The user terminal can be provided in either of two ways. First, it can be part of a "bundled" service offered by the DBS operator who charges a monthly or other periodic fee to cover the combined cost of the user terminal and the satellite reception services. For example, bundling is used by cable operators who supply set-top converters required for their multichannel service. This approach would permit

[8]Typical cost figures for overseas DBS terminals were obtained from Fred Judge, Hughes Communications, Inc., August 20, 1990.

[9]We note that "[evidence] suggests that Sky Cable is no longer clinging to one of its most noted claims, that it could offer a $300 retail TVRO system . . . [but instead] Sky Cable is hoping to offer a reception system in the $500 to $600 retail range" (Scherman, 1990, pp. 1, 37).

the household to subscribe to DBS service without bearing the large up-front expense of the user terminal, and to easily discontinue service with the DBS operator bearing the responsibility for installing and removing the terminal.

Second, the subscriber can buy (or lease) the terminal from some outside source, paying the satellite operator a periodic fee only for satellite reception. Unbundling is used in the HSD market, where subscribers procure their antennas and associated equipment from electronics retailers. The advantage of this approach lies in using a well-developed retail distribution system already in place. A potential disadvantage is that it involves wholesaler and retailer markups greater than 100 percent over manufacturing costs. An important question is whether markups might be higher than the distribution and marketing costs to the DBS operator who offers the terminal as part of a bundled service.

Conversion to Annualized Costs. To convert the costs in Table 2 to levelized annual costs required for comparisons with cable service, we use the methodology in Johnson and Reed (1990). We assume a 10-year and 20-year life, respectively, for electronic and nonelectronic equipment and a 10-year life for satellites.[10] Although the composition is not critical to our conclusions, we assume that 50 percent of the cost of the feeder link station and 75 percent of the cost of the user terminals consist of electronics. To convert investment costs into levelized annual costs we use a 17 percent discount rate to reflect the DBS operator's real pretax cost of capital. The 17 percent cost of capital with 10- and 20-year time periods converts, respectively, to annuity factors of 0.21466 and 0.17769.[11]

Table 3 displays the annualized costs for the major components listed in Table 2. These revenue requirements include interest on debt, return to equity holders, and income taxes, as reflected in the 17 percent discount rate. Of course, general inflation may affect dollar values during the period. Again, the figures here, and elsewhere in this study, are stated in real terms with a base time period of 1989–1990.

Figure 2 displays the estimates from Table 3 on a per-subscriber basis as a function of the number of subscribers. In this simple model, the system is built instantly, with all subscribers signing up at the

[10]These lifetimes are chosen because satellites generally have useful lives in the neighborhood of 10 years, and because electronic components are subject to more rapid economic obsolescence than other components (such as fiber optic cable). The 20-year assumption for nonelectronic components is the same as that in Johnson and Reed (1990) and is consistent with the estimates in Mitchell (1989, p. 22) drawing from telephone experience in California.

[11]See the discussion in Johnson and Reed (1990), p. 17 and Appendix I.

Table 3

ANNUALIZED INVESTMENT COST, MODEL DBS SYSTEM
(In dollars)

Component	Investment Cost	Lifetime (years)	Annualized Cost	Calculation for Annualized Cost
Satellites	400 million	10	86 million	400 (0.21466)
Launch	280 million	10	60 million	280 (0.21466)
Insurance	120 million	10	26 million	120 (0.21466)
Feeder link	75 million	10	16 million	75 (0.21466)
	75 million	20	13 million	75 (0.17769)
Total fixed cost			201 million	
User terminal #1	600	10	129	600 (0.21466)
	200	20	36	200 (0.17769)
Total	800		165	
User terminal #2	225	10	48	225 (0.21466)
	75	20	13	75 (0.17769)
Total	300		61	

beginning of the 10-year period. Figure 2 can most easily be interpreted under the assumption that the DBS operator offers user terminals as part of a bundled service. Figure 2 displays two systems: "DBS-1" which uses the $800 terminals, and "DBS-2" which uses the $300 terminals. The upper and lower horizontal lines indicate the annualized cost, respectively, of the $800 and $300 user terminals alone. (Points X and Y will be discussed below.)

To aid in comparisons, we assume initially that the services provided by the DBS system are comparable to those supplied by the hybrid copper/fiber cable network described by Johnson and Reed (64 channels for local and national programming).[12] This comparison carries the implicit assumption that a multiplication ratio of at least 2:1, using digital video compression, is incorporated in the DBS system to provide a minimum of 64 channels from 32 transponders.[13] (The effects of

[12]"Comparability of service" exists if the subscriber is indifferent between the service packages offered by DBS and cable systems; hence, subscriber choice is dictated only by relative prices.

[13]For DBS service comparable to 64 cable channels, somewhat more than 64 DBS channels may be needed to offset DBS's handicap in not being able to carry the signals of local broadcasting stations, while transmitting nationwide signals that in some cases are not available at optimal local times. These differences in services are discussed below.

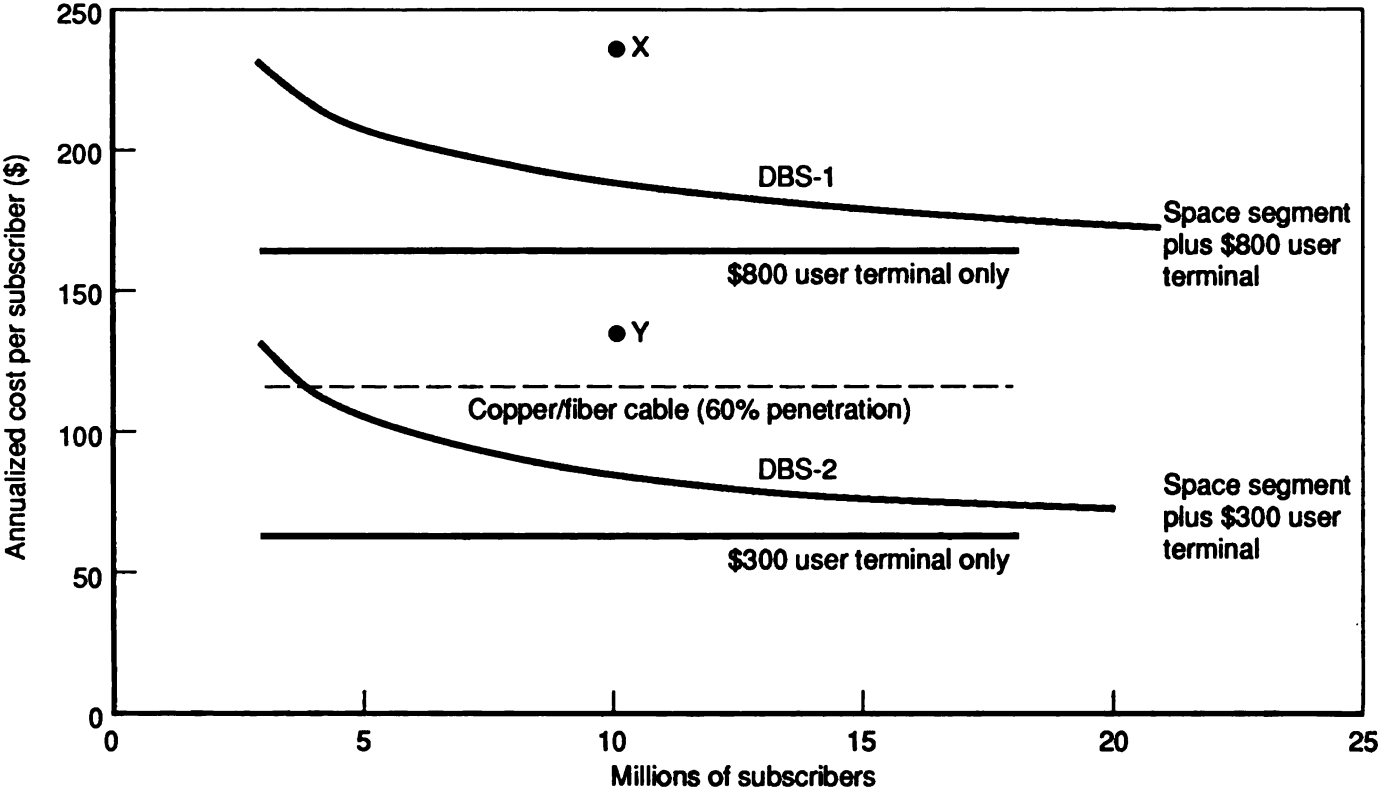

Fig. 2—Comparative annualized investment costs

higher multiplication ratios are considered below.) We also assume that DBS systems have comparable access to programming as cable, i.e., the same cost per subscriber for a given program. For comparisons, the horizontal dashed line is the estimated per-subscriber annualized cost (about $118) of the copper/fiber broadband cable networks (at the same 17 percent cost of capital) with 60 percent video subscriber penetration[14] required to serve the same number of subscribers.[15]

Figure 2 illustrates several key points. First, the relative costs of DBS and cable systems depend critically on the cost of the user terminals. DBS-1 ($800 user terminal) is more expensive than the cable system at all subscriber levels. DBS-2 ($300 user terminal) is less costly for any level of subscribership beyond four million.

Second, and not surprisingly, as the number of subscribers increases, each curve asymptotically approaches the annualized cost of the user terminal associated with it. Although the fixed investment cost of our model DBS system is nearly a billion dollars, the annualized fixed investment cost per subscriber at a penetration level of five million subscribers is only $40—much smaller than the annualized cost for the $300 and $800 earth terminals. At 15 million subscribers, the per-subscriber fixed cost is only $13.

Third, although Fig. 2 depicts a constant unit cost for user terminals, this cost would vary for two reasons. For a given set of technologies, unit costs will decline as the subscriber base increases, reflecting economies of large-scale production. Thus, sales to subscribers numbered only in the thousands instead of millions would involve higher unit costs that those in Fig. 2. Second, cost reductions resulting from technological advance over time will cause an overall fall in the cost curves. Thus, Fig. 2 might be regarded as a snapshot, say, for the technologies in 1995, while another figure with lower curves might represent a snapshot for the technologies in the year 2000.

Operating Expenses

In addition to investment costs, we must consider the range of operating expenses—such as general and administrative expenses, marketing, operation and maintenance of the satellite system, and

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[14]Johnson and Reed (1990), p. 19. A round figure of 60 percent penetration is typical in the cable industry. The percentage of homes passed that subscribe to cable has remained rather stable at 61 to 63 percent in recent years (FCC, 1990b, para. 4).

[15]A single cable network serves far fewer subscribers than the millions shown in Fig. 1. The per-subscriber cable network cost is based on a model of 25,600 households with a density of 88 households per linear mile. The horizontal line extending over millions of subscribers is based on an aggregation of such networks.

programming costs. The key question is how these expenses would compare with those of a cable operator, because cost differences can greatly affect outcomes.

One sample of cable systems in New England discloses that operating expenses constitute about 60 percent of revenues.[16] If this percentage is representative of the industry, overall operating expenses per subscriber were about $200 in 1989.[17]

The composition of operating expenses for the sample of cable systems is shown in Table 4. On a priori grounds, there is no reason to believe that per-subscriber general and administrative expenses and marketing expenses (42 percent of the total shown in Table 4) would significantly differ between DBS systems and large cable systems. But, with no DBS experience to draw on, differences could arise for unforeseen reasons.

A greater source of uncertainty surrounds network operation and maintenance. These functions differ greatly between cable and DBS systems. For example, the adjustment and replacement of line amplifiers and repair of cable breaks have nothing in common with DBS requirements. The primary costs of DBS systems are associated with operation of the business center and feeder link and maintenance of the user terminals. We do not have satisfactory estimates for these elements, because they include new technologies, such as video compression, that have yet to be commercialized. In any event,

Table 4

CABLE OPERATING EXPENSES PER SUBSCRIBER, 1989

Category	Amount ($)	Percent
General and administrative	59	29
Marketing	26	13
Technical[a]	46	23
Programming	73	36
Total	204	100

SOURCE: Continental Cablevision, Inc. (1990).
[a]Includes network operation and maintenance.

[16]FCC (1990b), para. 32, and Continental Cablevision, Inc. (1990).

[17]This round figure is computed on the basis of $17.7 billion industry revenues and about 50.1 million subscribers as estimated by Paul Kagan Association, Inc. (National Cable Television Association, 1990, pp. 1, 12, 13).

network operation and maintenance is not a large portion of the costs shown in Table 4.[18]

Whether programming expenses would be the same for the two media is a source of public policy concern, in light of evidence that media competing with cable must pay higher per-subscriber rates for programs. A discussion of the evidence and implications for public policy is contained in Sec. VII.

In Fig. 2, points X and Y illustrate the sensitivity of outcomes to differences in operating expenses for the case of the $800 user terminal. Suppose that our model DBS-1 system with 10 million subscribers incurs 25 percent greater operating expenses per subscriber than would cable networks—an increase of $50 over the estimated cable system figure of $204. Point X shows this annual cost on top of the annualized investment cost for DBS-1. Conversely, point Y shows the reduction in cost if operating expenses are $50 lower for DBS-1 than for the cable model. Point Y shows that the annualized cost of DBS-1 would remain higher than that of the cable model, but by much less than if per-subscriber operating expenses were the same for the two media. Conversely, even DBS-2 would be about as expensive as cable if its annual per-subscriber operating expenses were $50 greater than those of cable.[19]

Alternative Channel Multiplication Ratios

The space segment cost of our model DBS system depends on the channel multiplication ratio obtainable through advances in digital video compression. A tradeoff exists between the channel multiplication ratio and the number of satellites needed to provide a given number of channels to the subscriber.

For example, an 8:1 ratio would permit 256 channels from our four-satellite system.[20] Whether as many as four satellites would be used here would depend on whether a market for the additional channels exists to cover the cost of supplying them. For 64 channels, as in the fiber/copper model, one satellite with eight transponders would suffice. If we assume one on-orbit spare (its channels could be used on a pre-

[18]One can imagine substantial maintenance expenses for user terminals if, for example, they must be readjusted after being knocked out of alignment during windstorms. This is one reason why small antennas are so important. A reduction in antenna diameter from three feet to one foot reduces its exposure to head-on wind loads by nearly 90 percent.

[19]The $50 annual expense is equivalent to raising or lowering the cost of the user terminal by $240.

[20]For a high-powered DBS system, an 8:1 channel multiplication ratio is probably conservative, as discussed in Sec. VII.

emptible basis), the space segment cost would be $360 million. Including the feeder link and business center cost of $100 million (reduced from $150 million because of smaller uplink requirements), the total fixed cost would be $460 million—about half the figure estimated for our four-satellite model.

Figure 3 shows the effect of this cost reduction, with the reduced fixed cost superimposed on the earlier one. Most notably, overall cost is not much affected for subscriber levels of five to 10 million. The cost of user terminals and operating expenses remain of primary importance. However, the reduction in fixed costs would reduce up-front risk and encourage the entry of additional DBS systems. Thus, the channel multiplication ratio obtained may play a central role in affecting the willingness of investors to proceed and the competitive threat posed for cable systems.

COMPETITION WITH EXISTING CABLE SYSTEMS

The viability of DBS as a competitor to cable depends on whether subscribers can be attracted from cable to a DBS system at the same time that the DBS system covers its total cost. Whether total cost would be covered depends on factors illustrated in Fig. 2. Using plausible assumptions, our calculations show that DBS-1 is not promising as a competitor to cable. Suppose that the system with the $800 terminal (DBS-1) and large cable systems have the same per-subscriber operating expenses—equal to the $200 estimate noted above. Suppose further that, to be competitive, DBS-1 is constrained to have subscriber rates no greater than those of typical cable systems, so that its annual per-subscriber revenues are no higher than the industry average, which was $347 (including advertising) in 1989.[21] Operating income (the difference between $347 and $200) is $147. However, the annual revenue required to cover the investment cost of DBS-1, with 10 million subscribers, is nearly $190, shown in Fig. 2, well in excess of $147. Thus, DBS-1 does not cover its total costs with 10 million subscribers nor, for that matter, at any other subscriber level. Indeed, the annualized cost of the $800 user terminal by itself ($165) exceeds the margin between revenues and operating income.

The difficulties faced by DBS-1 are further illustrated by comparing its cost with that of the copper/fiber network in Fig. 2. In new communities, such a network could be built at a per-subscriber cost (at a 60 percent penetration level typical in the industry) of about $600[22]—far below that even of the $800 user terminal alone.

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[21]Computed from data in this section, footnote 11.

[22]Johnson and Reed (1990), p. 80, estimate a figure of $614.

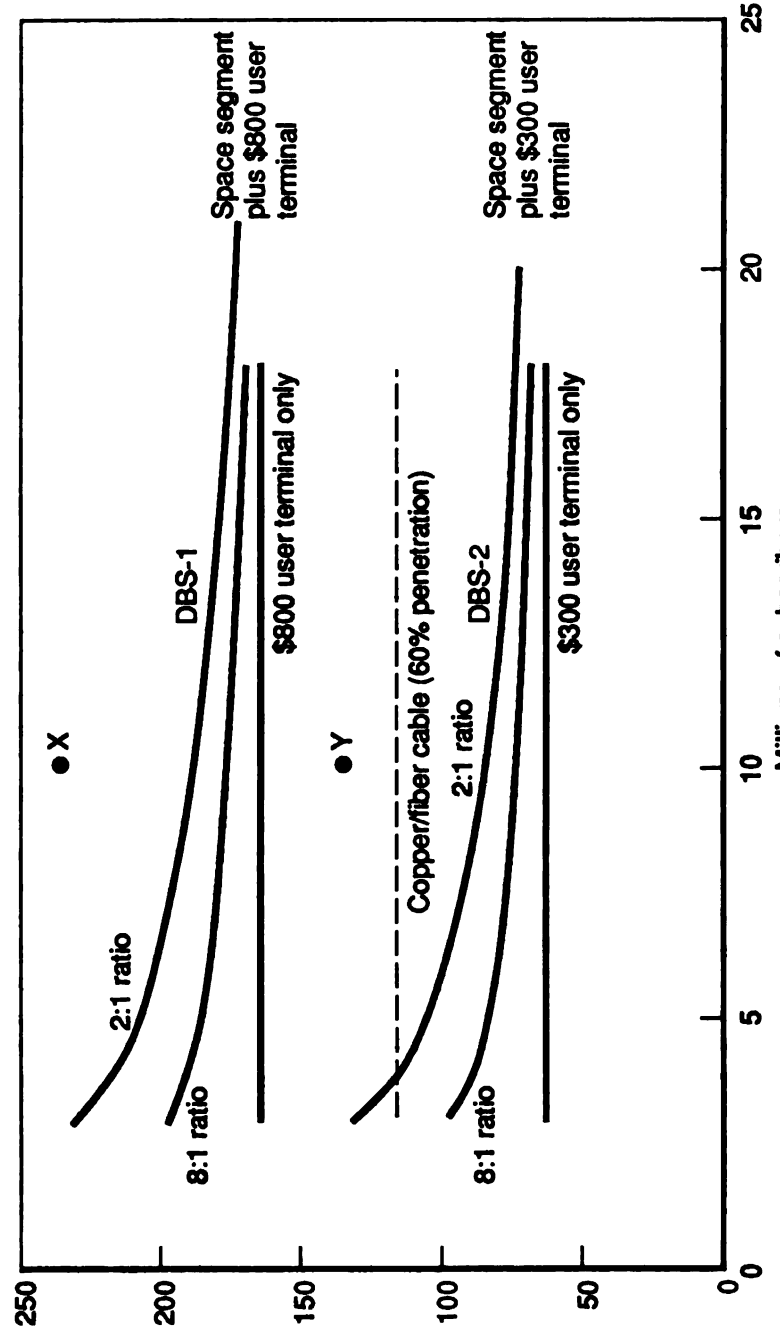

Fig. 3—Comparative annualized investment costs: alternative channel multiplication ratios

Thus, we conclude that, *if services are comparable,* DBS-1 would probably be confined to areas without cable. As noted above, about 10 million households are not passed by cable. Suppose that DBS-1 could attract about 30 percent or three million of those households, with subscription rates 30 percent higher than the average for the cable industry. With annual per-subscriber revenues of $451 and the same $200 operating expenses as before, the operating income of $251 would exceed the investment cost of $230 shown for three million subscribers in Fig. 2. Under these assumptions, DBS-1 appears economically viable in this limited market, if the market remains at today's 10 million households. However, the market is shrinking as cable construction expands into previously unserved areas, so the viability of DBS-1 would remain uncertain in the longer term.

In contrast, DBS-2 is a much more promising competitor to cable. The annual operating income of $147 computed above is well in excess of the $70 annualized investment cost shown in Fig. 2 for 10 million subscribers. At that subscriber level, DBS-2 would break even with a per-subscriber revenue of $270 (operating expenses of $200 plus $70 investment cost)—22 percent below our cable revenue estimate of $347.

To be sure, seeking to forestall DBS market entry, cable systems would be expected to cut subscriber prices—reductions perhaps exceeding the 22 percent margin estimated above. In this case, the maximum price charged by DBS-2 would fall short of generating sufficient revenues to cover cost. However, the prospects for DBS-2 would be strengthened by the fact that it has a national market to draw from, where individual households face widely varying circumstances. DBS-2 subscribers would be drawn from markets not served by cable, and households dissatisfied with their local cable service (for any of a number of reasons) would also be attractive candidates for DBS service. In other cases, cable operators might be reluctant to substantially reduce their prices because of abnormally high operating costs. Of key importance is that DBS-2 would need to attract only a small fraction of the nation's households—perhaps five million or so—to emerge as a widespread competitor to cable.

Also relevant is the fact that the investment cost of DBS-2 is below that of copper/fiber cable for subscriber levels greater than four million for a channel multiplication of 2:1, and for subscriber levels above two million if the multiplication ratio is 8:1. In new communities, or in those where old cable systems must be replaced, DBS-2 services could be priced lower than those for a new cable network. Even if some households were willing to subscribe to cable at a higher price than that for the DBS system, the cable operator may not find this an attractive market. Recall that the costs shown for the copper/fiber

network presume a 60 percent penetration level. Suppose that the presence of DBS-2 cuts the prospective penetration level for cable to 20 percent. The per-subscriber cable cost would more than double—from the $118 shown in Fig. 2 to about $281.[23] With such an increase, the cable operator might be deterred from entering the market, or from rebuilding an old cable system, leaving all households dependent on off-air service. This dependence raises important public policy issues, as discussed in Sec. VII.

More generally, we suggest that the cost of user terminals would have to fall within the range of about $300 to $500 for DBS to be competitive with cable under widely varying local circumstances. This conclusion is based on the relative costs shown in Figs. 2 and 3, taking into account several factors that work in opposite directions.

First are factors on the DBS side. The assumption that DBS subscribership grows instantaneously to assumed levels illustrated in Figs. 2 and 3 is obviously unrealistic. The buildup of the subscriber base would extend over years. Working in the other direction is the fact that the total space segment cost would not be incurred immediately. Rather, the four satellites in our model, illustrated in Fig. 2, would be launched over a period of perhaps two or three years. Even one such satellite might provide attractive service for early subscribers. Moreover, suppose that a channel multiplication ratio of 8:1 is successfully commercialized, as noted above. One or two such satellites could sustain early DBS growth, with both system capacity and subscribership rising over time. Indeed, depending on the demand for channels, the system might ultimately include only one or two such satellites, rather than the four in our model, which would reduce up-front investment and risk.

Second are factors on the cable side. The model cable coverage shown in Fig. 2, based on 88 homes per mile and 60 percent subscriber penetration, involves a per-subscriber investment cost of $613. A lower housing density would raise this cost. In this model, a fall in density to 60 homes per mile would be accompanied by a rise in per-subscriber investment cost to $730—an increase of 19 percent.[24] At the same time, this model presumes full underground installation. Especially in low-density areas, many installations are aboveground (on poles shared with telephone and power companies), which reduces per-subscriber investment costs. Finally, the model, using 60 percent penetration, reflects the industry average. A penetration below or above that level for individual systems would affect per-subscriber costs accordingly.

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[23]Computed from Johnson and Reed (1990), Table G.2.

[24]Ibid.

In summary, a range of roughly $300 to $500 would give our model DBS system leeway to compete in a variety of cable markets. DBS would have the greatest appeal in areas where (a) low population density increases the cost of cabling, (b) cable networks have low subscriber penetration, and (c) cable networks are of low-capacity, obsolete design. Again, outcomes would be markedly affected if DBS per-subscriber operating expenses vary substantially from those of cable networks.

DBS AND SECOND CABLE SYSTEMS

In addition to competition between DBS and cable systems, how do second cable systems compare to DBS as a competitor to cable? To answer this question, we evaluate the threat of entry by a DBS system against an incumbent cable operator and compare it with the threat posed by a second cable system. The second cable system could be owned either by an outside cable operator or, if the crossownership ban were eliminated, by a telephone company.

A potential second cable system would face a markedly different situation from that of a DBS provider in seeking to enter a market in competition with an incumbent cable operator. The wireline company must install broadband lines and electronics to pass essentially all the homes in a locality to reach those desiring service. Moreover, once installed, the facilities would be largely a sunk cost. They could not easily be moved to other geographical locations if the company fails to attract enough subscribers to cover total cost.[25]

In contrast, a DBS system has greater flexibility of operation, with less sunk cost. Rather than laying lines past, say, 10 homes to reach the one desiring service, only the installation of the home satellite earth terminal is required. Moreover, if the subscriber later terminates service, this user terminal could be moved to another location without great cost.

To be sure, the DBS operator must incur the up-front cost of the space segment and ground terrestrial infrastructure—amounting to perhaps $1 billion. Although this amount might seem large, it provides instantaneous CONUS coverage of more than 90 million households. In comparison, for their illustrative hybrid copper/fiber cable network passing 25,600 households, Johnson and Reed (1990, Table G.2) estimate an investment cost of $260 per home passed, minus the costs of

[25]The electronic components would be movable, but the cable installation, including labor costs, would be sunk. About 55 percent of the cost of the model cable system illustrated in Fig. 1 consists of nonelectronics (Johnson and Reed, 1990, p. 88).

connecting individual households to the network. Using this figure, an expenditure of $1 billion on cable networks would be sufficient to pass only about 3,846,000 households—less than 8 percent of existing cable television households and less than 5 percent of all households in the CONUS. DBS systems would be even more attractive if high channel multiplication ratios (such as 8:1 discussed above) can be successfully commercialized, enabling reductions in fixed costs.

Moreover, the space segment is not entirely a sunk cost. Satellites intended for DBS service can have alternative uses, facilitated by the fact that they simply retransmit whatever they receive. It is of no consequence to the satellite, within its capacity constraints, whether the signal is digital or analog, scrambled, or involves data, voice, or video. Thus, if the DBS operator fails to cover cost, satellite transponders probably could be leased or sold to other users.[26] Whatever cost recovery is afforded by these other uses would reduce the cost of abandoning the DBS business.

In light of the above, suppose that the incumbent has paid $2,000 per subscriber for a recently acquired cable system that has a plant replacement cost of $600 per subscriber—a situation common in the industry.[27] Suppose, further, that in the absence of competition revenues are high enough to justify the high purchase price. The prospective wireline entrant is attracted by the disparity between the $2,000 per subscriber buying price and the $600 replacement cost, which suggests that substantial profits could be earned by constructing a similar plant alongside that of the incumbent (to offer essentially the same kinds of services) rather than buying out the incumbent's network at a price of $2,000 per subscriber.

However, the incumbent, aware of this possibility, could reduce subscriber rates if the wireline company initiates construction. At the limit, it could cut rates to its out-of-pocket or variable cost (i.e., operating expenses), which would be perhaps 60 percent of today's revenues, as noted above. To be sure, the incumbent might go bankrupt in carrying out this strategy, since it could not recover the $2,000 purchase price. Nevertheless, the system would continue to be operated, either by the financially reorganized incumbent or by a new purchaser, as long as variable costs are covered.

Aware of the incumbent's advantage, the wireline company would likely be deterred from entering. To serve the area would require a large investment regardless of how many subscribers sign up. If the

[26]In its early decisions to establish DBS service, the FCC agreed to permit DBS facilities to be used for other purposes on a "secondary" basis (FCC, 1986, para. 2).

[27]These figures are in line with those estimated in FCC (1990b), Appendix E, footnote 11.

incumbent were to carry out its price-cutting strategy, the entrant would have little hope of recovering its total costs, since its wireline facilities could not easily be moved to another market. Thus, the prospective entrant would be deterred and the incumbent would be relieved of the need to reduce prices. The key point is that many of the incumbent's costs (the $2,000 purchase price) are sunk (nonrecoverable), but none of the prospective entrant's costs are sunk before entry—a situation that gives the incumbent an economic advantage.

This situation is an example of a "noncontestable" market.[28] The incumbent is protected because the prospective newcomer faces costs of entry and exit that are too high to render the threat of entry credible. For this reason, overbuilding by a cable entrant against an incumbent rarely occurs. Threats of overbuilding typically are empty or lead to a buyout.[29]

In contrast, the DBS operator with satellites in orbit would enter a local market if any of the households were willing to pay enough to cover the cost of the terminal, with the fees for satellite service covering the space segment and other fixed costs. The threat posed by the incumbent cable operator's cutting prices has less force here. In the extreme, in response to a price cut by the cable operator down to variable cost, the DBS user terminals could be moved to other markets where households are willing to subscribe. Moreover, as noted above, the alternative uses of the space segment provide additional flexibility. If entry and exit costs are low, the market becomes "contestable." The "hit and run" threat of DBS entry may be sufficient to induce the cable operator to reduce prices and improve services even if DBS attracts no subscribers in that particular market. In other words, the mere threat of entry may be sufficient to force the cable operator to behave as if the industry were competitive.

In short, the DBS operator has greater flexibility than does a wireline operator. With the whole nation as a market, the DBS operator can draw from millions of potential subscribers. Unlike the case of wireline, the DBS operator does not need a large minimum penetration level in any given community to break even. Rather, the challenge is to aggregate enough subscribers across the nation to cover total cost.[30]

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[28]The seminal development of the concept of contestability is by Baumol et al. (1982). A critical assessment of the concept, with many cites to the literature, is by Shepherd (1984).

[29]About 40 to 50 second cable systems are reported to be in operation (FCC, 1990b, para. 98). To be sure, overbuilding is also discouraged by restrictive local franchise agreements—a point emphasized by Hazlett (1990). If local franchises were the primary barrier to multinetwork competition, the obvious solution would be to prohibit exclusionary local franchises. Even with such a prohibition in place, however, overbuilding would remain a dubious venture in most cases because of high entry and exit costs.

[30]According to a 1990 consumer poll commissioned by *Cable World*, 36 percent of cable subscribers said that they would switch to a DBS service if the ground terminal

DIFFERENCES IN SERVICES

We have so far assumed that the services of DBS and cable systems are identical. We relax that assumption here to consider ways in which services might differ and how competitive positions would be affected.

DBS systems, with their national coverage, are limited in their ability to carry locally originated programs. If a DBS system had a very large channel capacity through the use of digital video compression, some channels could be used to retransmit locally broadcast programs. But even such high-capacity systems could carry only a fraction of the more than 1,400 VHF and UHF local signals that are broadcast today.[31] Moreover, the transmission of local broadcast signals over hundreds of miles to the feeder link station would involve additional costs not included in our model.[32] In contrast, cable networks are easily able to carry all or most of the signals of local broadcasting stations.

DBS subscribers would have to resort to VHF/UHF antennas to receive local signals. This would handicap DBS in competing with cable, especially in areas with poor over-the-air reception.

Conversely, the retransmission of some local broadcasts by a DBS system would provide a nationwide audience for these selected broadcasts. Such retransmission may also spur the growth of regionalism, whereby a number of regional channels—each representing a particular region of the United States (e.g., Southern California or the New York City area)—could be broadcast nationwide.

In addition, DBS systems may be able to offer more national programs than cable, depending on the degree of video compression used to increase system capacity. The additional channels might be attractive for "narrowcast" programming geared to specialized viewer interests.[33] Of course, high-capacity cable systems also can fill

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cost $500, the programming availability was similar to that offered by cable, and the monthly service charge was $5 less than they pay for cable. See "For Cable Operators, Some Kudos, Caution, and One Dark Cloud," *Cable World*, May 21, 1990, p. 91. We cannot vouch for the reliability of this subscriber survey as an input for estimating the demand for DBS, however. We note the response here only to suggest that this kind of information may be affecting investor expectations.

[31]In addition to the 1,448 stations on the air as reported in *Broadcasting*, July 2, 1990, p. 61, construction permits were pending for 233 others. Moreover, 757 low-power VHF and UHF stations were in operation, many of whose signals are carried on cable.

[32]Alternatively, multiple uplink terminals, situated closer to local broadcasting stations, could be installed. The additional costs of doing so are not included in our model.

[33]One might argue that viable new markets exist for narrowcasting because advertisers are willing to pay a relatively large amount per viewer to pinpoint those who are especially interested in the product being sold. Thus, a program aimed at fishing

channels in this way. Indeed, they have been highly successful in encouraging the emergence of dozens of cable networks and other program offerings geared to special-interest audiences. A DBS system might go even beyond these efforts, by virtue of its instantaneous nationwide coverage, to facilitate the aggregation of small numbers of scattered viewers. Although local cable systems can be linked to provide much the same coverage, the varying local channel constraints and the difficulties of coordinating the actions of hundreds of such systems pose complications that a DBS system would avoid.

With DBS nationwide coverage, one can imagine access to a variety of programs not now available. Provision of additional institutional and educational programming is one possibility; carriage of professional sports, beyond levels now possible with cable and other media, may also be an attractive option for DBS systems. Another possibility is to assign duplicate programs to channels—one with and one without advertising—to permit the viewer to choose whether to pay a premium for the offerings free of advertising. Whether a viable market exists for such programs is a question beyond the scope of this study.

Of course, video compression is not uniquely applicable to DBS. Analog video compression methods are available for existing cable systems, but, as discussed below with respect to wireless cable, current technologies are costly and reduce reception quality. More important, analog methods are inherently limited in the degree of compression obtainable. Digital video compression, on the other hand, could greatly increase system capacity. This application would require conversion of existing cable systems to handle digital transmission.

One approach being considered by the cable industry is to continue using the existing range of 50 to 550 MHz for analog transmission and to superimpose on it digital transmission in the 550 to 750 MHz (or higher) range, depending on the bandwidth characteristics of cable amplifiers.[34] In this hybrid approach, additional programming with digital video compression would be offered to those willing to pay for the extra channels, without altering service to other subscribers.

At the same time, subscriber appeal depends on more than just the sheer number of channels. Cable systems transmit programs to take into account the CONUS time zones. A popular pay movie shown at 8 P.M. local time in New York can also be shown at 8 P.M. local time in

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enthusiasts might be an attractive advertising medium for fishing supply manufacturers. A difficulty, however, is that the *per-viewer* cost of producing television programs for small audiences is also high. The fact that fishing supply manufacturers advertise widely in fishing magazines reflects the low per-reader cost of producing print material, even for publications with small circulations.

[34] *Video Technology News*, November 19, 1990, p. 4.

Los Angeles. In contrast, with full CONUS coverage, many signals would not be available at the most appropriate local time. Thus, a system carrying 100 time-optimized channels might have greater subscriber appeal than would 150 channels each covering the CONUS.[35]

HDTV could become an important market during the latter part of the 1990s. Satellites are well suited for this service. The FCC is now considering alternative transmission standards for terrestrially broadcast HDTV. The FCC has already decided that any standard selected must be compatible with a 6 MHz terrestrial allocation, and its selection of a transmission standard is expected in 1993. HDTV receivers will be designed for compatibility with that transmission standard, and both cable and DBS systems, as well as broadcasting stations, will be able to use that standard.

However, DBS may have an advantage in introducing HDTV. The conversion of one DBS feeder link will permit instantaneous national coverage by satellite. For this reason, the first HDTV signals widely available to households may be transmitted by DBS satellites. In contrast, broadcasting stations will require costly retrofit for HDTV use.[36] Large urban stations will probably be the pioneers in this conversion process. Depending on channel capacities and other technical characteristics, some cable systems will be more adaptable for HDTV use than others. Retrofit of cable networks will probably proceed at an uneven pace. Consequently, cable systems and broadcasting stations will provide only patchwork coverage for HDTV during its early years. Depending on the sales growth of HDTV receivers, the emergence of HDTV could provide an additional impetus to market penetration by DBS systems, and vice versa.

In summary, DBS systems will suffer a disadvantage in not carrying local signals. Working in the other direction is the possibility of DBS carriage of many more signals through the use of digital video compression. These channels' value to the viewer will be affected by whether access is afforded during the most convenient times of the day. More generally, the attractiveness of DBS service will depend on the varying tastes of subscribers. For those who highly value locally originated programs, including local news and sports, cable service would have greater appeal, especially in areas of poor over-the-air reception. For

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[35]Of course, with a large enough number of DBS channels, a popular pay movie could be transmitted at different starting times to account for the different time zones used in broadcasting. This approach would have the added benefit of allowing a subscriber in a given time zone additional choice among starting times.

[36]According to one report, the conversion cost for a broadcasting station will be from $5 million to $10 million. A study by CBS predicts a transition time lasting from five to nine years ("New HDTV Estimates: 12 Million or Less," *Broadcasting*, October 29, 1990, p. 33).

those who watch mainly movies and other programs with a national market, DBS may have the edge. The introduction of HDTV could also stimulate the growth of the DBS market. More generally, DBS systems will give consumers added choices in terms of both price and service. The key question is whether these combinations of price and service will appeal to a wide enough audience to render DBS a strong competitor to cable. The answer depends, in part, on the nature of technological advance, a subject to which we now turn.

EFFECTS OF TECHNOLOGICAL ADVANCE

As noted above, a DBS system can transmit multiple signals to cover the nation at a much lower cost than would be involved in passing every home with cable. The critical question relates to the investment and maintenance costs of the user terminals required to receive these signals. An $800 terminal investment would, by itself, be greater than the per-subscriber investment for most cable systems.

What factors will determine how fast these terminal costs decline? The largest terminal cost component is the IRD. The extensive digital processing and signal access control will result in high initial costs. As these digital electronics costs fall, as they have done dramatically in the past, the IRD cost will also fall.

Of critical importance, then, is technological advance—not only in terms of how it affects the cost of IRDs but also how it affects competitors to DBS systems. Advances in digital signal processing and related technologies would favor DBS over cable systems, because a large portion of the cost of any wireline system involves labor-intensive installation and maintenance. We expect that many of the inputs—such as conduits, ducts, and sheathing—will not enjoy significant reductions in real costs. In contrast, in a DBS system the bulk of the costs are embedded in electronics in the subscriber's terminal, and it is here that we would expect technological advance to make the greatest contribution, as it has in the past.[37] While these advances will also favorably affect wireline systems, especially those embodying fiber optics where electronics are a large component of total cost, they may affect DBS systems even more favorably by reducing the costs of user terminals. If so, DBS systems will become progressively more attractive, relative to cable systems, with the passage of time.

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[37]The electronics portion of the copper/fiber model constitutes about 45 percent of total cost (Johnson and Reed, 1990, p. 88). Perhaps 75 percent of the cost of DBS user terminals would be for electronics. Technological advance may also differentially favor development of integrated broadband networks because of their heavy reliance on electronics, as discussed by Johnson and Reed.

If we assume comparable service offerings between DBS and cable, the high initial terminal cost will restrict the DBS market primarily to noncable areas. If terminal costs fall to the region of $300 to $500 during the 1990s time frame of our analysis, DBS systems will be well positioned to compete with cable. Especially in areas where existing cable systems are expensive because of low housing density, competition could force the cable operator eventually to abandon the cable system when it needs rebuilding or extensive retrofitting, leaving everyone in the franchise area dependent on off-air service. In other cable franchise areas, a mix of cable and noncable subscribers would emerge. Even if DBS penetration is low (say 5 percent to 10 percent of all TV households), the aggregation of DBS subscribers across the nation would run from five million to 10 million. This level would be high enough to largely exhaust the scale economies illustrated in Figs. 2 and 3 for a single DBS system. With sufficiently favorable costs, several DBS systems could compete head-to-head, in addition to competing with cable. If each of, say, three systems eventually had a subscribership in the neighborhood of 10 million, the multichannel market would be divided about equally between cable and competing DBS systems.[38]

[38]Such an outcome raises the issue of whether the number of firms in the market exceeds the number that is socially efficient. Several analysts show a tendency toward *excessive* entry in markets where fixed costs exist (as they do here) and the product is homogeneous (see Mankiw and Whinston, 1986; von Weizsacker, 1980; and Perry, 1984). This result stands in contrast to analysis of conditions under which *too little* entry takes place (see Spence, 1976; and Dixit and Stiglitz, 1977). A limitation of the literature suggesting a bias toward excessive entry is that it takes firms' cost functions and product mix as exogenous variables. No consideration is given to the possibility that competition will increase the technical efficiency of firms or will increase socially desirable product diversity. Generally speaking, the greater the effect of competition (measured by number of firms) on technical efficiency and product diversity, the larger the socially optimal number of firms.

IV. OTHER MULTICHANNEL ALTERNATIVES TO CABLE

To assess more fully the potential of DBS systems, we must take into account other multichannel alternatives. Here we consider the technical and economic characteristics of wireless cable, HSD, and SMATV systems as potential competitors to both DBS and cable systems.

WIRELESS CABLE

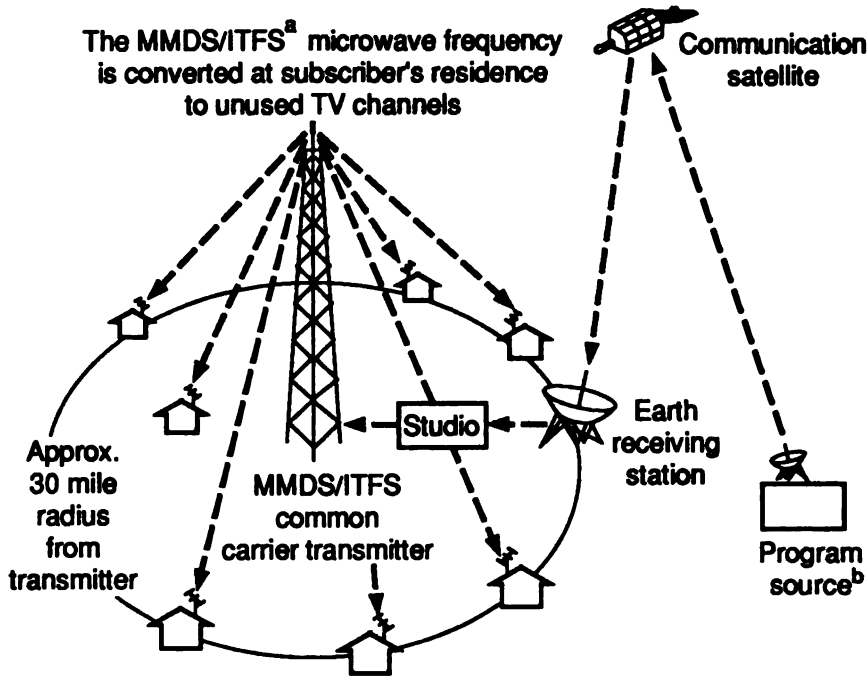
DBS systems are not unique in their flexibility to serve selected households, as noted in Sec. III. Wireless cable systems, illustrated in Fig. 4, have similar characteristics. A user terminal is needed only for households that want service, and user terminals can be moved from one location to another. Why, then, would not wireless cable play as big or an even bigger role than DBS in competing with cable? In response, wireless cable has three advantages, and two disadvantages, relative to DBS.

Advantages

Low-Cost User Terminals. The user terminals, consisting of small rectangular panel antennas and simple frequency downconverters, are cheaper than even the $300 illustrated above for our model DBS-2 system. However, this cost difference arises, in part at least, because digital compression techniques and signal access control for security are not incorporated in the wireless cable system as they are for our model DBS system. If they are included, a complex IRD will also be required at each wireless cable user terminal. Any remaining cost differential between the two systems would reside in the outdoor units—the antenna and frequency downconverter.

Carriage of Local Signals. If channel capacity is available, wireless cable can easily carry local broadcasting signals. Local signals can be picked off the air with a master antenna, fed into the studio, and retransmitted over the wireless cable system.

However, many wireless systems choose not to use their limited microwave channels for transmission of local signals—at least in areas with good over-the-air reception. Instead, the wireless terminal is sold


The MMDS/ITFS[a] microwave frequency is converted at subscriber's residence to unused TV channels
Communication satellite
Studio
Earth receiving station
Approx. 30 mile radius from transmitter
MMDS/ITFS common carrier transmitter
Program source[b]

[a] Multichannel multipoint distribution service/instructional television fixed service
[b] Programming may also be originated at the studio via videotape

Fig. 4—Illustration of wireless cable network

as part of a package that includes a VHF/UHF antenna for receiving local broadcasts.[1]

Less Vulnerability to Rain Fade. The lower radio frequencies used for wireless cable are much less susceptible to rain fade than is true for the frequencies allocated to DBS. The problem can be handled in DBS systems by designing rain-fade margins at additional system cost, but infrequent outages (during periods of exceedingly heavy rainfall) are nevertheless expected to occur.

[1] A DBS terminal could also include a VHF/UHF antenna to receive local broadcasts, as part of a package deal.

Disadvantages

Line of Sight Requirements. These requirements are difficult to meet because of the low upward elevation angles between user antennas and the microwave tower. If the transmitter tower is 500 feet tall, for example, a user antenna 10 miles away would have less than a one-half degree elevation angle. In contrast, a satellite in geosynchronous orbit would enable a much steeper viewing angle (the precise angle is determined by the satellite's orbital position and the user's geographical location). Figure 5 shows that from a satellite located at 110 degrees west longitude (W.L.)—one of the eight orbital positions designated for domestic DBS service—ground antenna elevation angles would range from about 25 degrees to 55 degrees over the entire CONUS.[2] Thus, hilly terrain, trees, buildings, and other obstructions are much more of a problem for wireless cable than for DBS.

Signal coverage can be improved with signal boosters, which receive the signal and retransmit it in a different direction. To illustrate, suppose a group of dwellings is shaded from the primary transmitter by a hill. The signal booster, located at one side of the hill, receives the signal and retransmits it to the shaded dwellings.

However, potential signal interference poses a problem that militates against widespread use of boosters. For this reason, the FCC has recently decided "that boosters should be subject to FCC certification like all other transmitter equipment, including main station transmitters."[3] The Wireless Cable Television Association (WCA) stated, before the FCC decision was adopted, that "WCA believes that the Commission's proposal to require that each booster be applied for and authorized as if it were a primary transmitter will make it economically impossible to utilize boosters to serve areas other than large multiple dwellings."[4] Thus, line-of-sight requirements will remain a handicap for wireless cable.

Limited Channel Capacity. Under proposed FCC regulations, wireless cable would have a maximum of 33 6 MHz channels, derived from combining channels from several applications: ITFS, MMDS, and

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[2]Because a high elevation angle reduces signal atmospheric (rain) loss and signal blockage from obstructions, the ideal antenna elevation angle would be 90 degrees (antenna pointing straight up). This is possible only at the equator, directly beneath the satellite at its *subsatellite point*. The 110 degrees W.L. position, whose coverage is illustrated in Fig. 3, is one of three that enable full CONUS coverage. The position at 101 degrees W.L. permits even steeper antenna elevation angles across the CONUS. The position at 119 degrees W.L. enables about the same elevations from the West Coast but requires lower elevations from the East Coast compared with those illustrated in Fig. 4.

[3]FCC (1990c), para. 83.

[4]Wireless Cable Television Association (1990), p. 101.

Fig. 5—Elevation angles for pointing at a satellite located at 110 degrees West Longitude

others.[5] Because of these other uses, 20 of the 33 channels would be available to wireless cable only on a shared basis (typically late afternoons, evenings, and weekends).[6] In contrast, a single DBS orbital position contains 32 transponder channels, each with 24 MHz bandwidth. Thus, each of the eight orbital slots allocated to DBS has about the same number of (uncompressed) channels as the maximum available for wireless cable. Moreover, digital compression will multiply DBS channel capacity many times over, depending upon the compression ratios that eventually become feasible.

Wireless cable can also use video compression technology. One analog system, developed by Comband Technologies, Inc., was explicitly included in the FCC's recent inquiry into ways to improve the potential of wireless cable. This technology permits transmission of two separate video signals on a single 6 MHz channel. Cost and degradation of reception are two problems that were noted by the Commission,

[5]FCC (1990c). In many cases, however, the maximum of 33 channels will not be available to individual wireless cable operators because of such problems as the need to collocate transmitters and the inability to lease a full complement of 20 ITFS channels.

[6]For a more detailed discussion see FCC (1990a).

but these may be lessened in future analog systems.[7] For all such systems, however, the channel multiplication ratio will remain low relative to that which will be available through digital compression technologies.

Digital compression approaches for DBS systems would also be applicable to wireless cable. As discussed in Sec. III, the indoor unit (the IRD)—which will process the digital signals—initially will contribute a large proportion to the cost of the DBS terminal. Adoption of digital compression technologies *before such technologies mature* would likewise add significantly to the cost of the wireless terminal. Militating against early use of digital video compression for wireless cable (and other terrestrial systems) is that the payoff in channel multiplication would be less. As discussed in Sec. VI, *for a given amount of digital video compression*, the number of compressed channels that will fit in a 6 MHz terrestrial channel will be about one-half of that possible for a 24 MHz DBS channel.

Wireless cable is experiencing rapid growth, but from a small base. About 50 systems are serving approximately 300,000 subscribers, with numerous additional systems planned.[8] Wireless cable may play a valuable role in providing a limited choice of channels at a lower price than that charged by cable operators, and by covering some areas of low population density not served by cable. But this role will be restricted because line-of-sight constraints preclude service to many households. On a nationwide basis, the combination of line-of-sight constraints and limited channel capacity renders wireless cable a less-potent competitor than DBS to cable systems. In some local markets where this combination is less of a problem, however, wireless cable can (and does) pose a competitive alternative to cable.

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[7]FCC (1990c), para. 46. The Commission observes, "Most commenters question the feasibility of Comband technology as a source of additional channel capacity. They contend that it is expensive, is subject to picture degradation, and may lead to increased co-channel and adjacent-channel interference. They also note that Comband is, for the most part, not currently in use. Other commenters would welcome widespread use of Comband and note that an alternative Comband-like technology may soon be available which is less costly than current Comband equipment and does not suffer the picture degradation encountered in Comband systems."

[8]FCC (1990b), para. 100, footnote 144. The FCC's records of April 20, 1990, show "126 outstanding construction permits, 892 identified lottery selectees, and 1293 pending uncontested applications on file."

HOME SATELLITE DISHES

The market for *new* HSD terminals would probably disappear in response to low-cost DBS systems with attractive programming. Use of *existing* HSD terminals would continue, encouraged perhaps by development of program packages designed specifically for HSD owners. For example, the TVN Entertainment Corporation is planning to occupy 10 C-band transponders on AT&T's Telstar 303 satellite for pay-per-view movies, initially targeted to HSD owners.[9] In response to attractive DBS offerings in later years, existing HSD owners would probably abandon their obtrusive units if, over time, they require expensive maintenance or if aesthetics dictates a change to smaller antennas. One factor that will encourage retention of HSD terminals, however, is the multitude of channels to which the HSD user will continue to have access in the C-band.

SATELLITE MASTER ANTENNA TELEVISION SYSTEMS

SMATV systems are essentially cable systems fed by HSD-type terminals to serve apartment buildings and other high-density dwellings. These systems have lost market share, with subscribership dropping from one million in 1987 to one-half million in 1989.[10] This decline reflects, in part at least, the fact that some SMATV systems were built in areas that at the time did not have cable service. Once cable service became available, the cable operators bought out the SMATV systems and integrated them into their own networks.

DBS operators will probably seek to negotiate arrangements with SMATV systems by attractively pricing access to the programming. Conversion of the SMATV large C-band terminal to the smaller DBS terminal would have an aesthetic advantage. However, if the DBS system uses digital video compression, this DBS terminal would likely be as expensive, if not more expensive, than an existing C-band unit until an IRD specifically designed to accommodate multiple channels being viewed simultaneously becomes available. In the meantime, a separate IRD would be required to tune into each channel intended for distribution on the SMATV system.

The size of the potential DBS market for high-density housing will likely encourage the development and commercialization of a multiple-dwelling IRD to lower the cost for the SMATV application. If these

[9]TVN Entertainment Corporation, "TVN Entertainment Launches Satellite Movie Rental Service," press release, Santa Monica, California, September 14, 1990.

[10]FCC (1989b), para. 106.

efforts are successful, DBS-based SMATV systems would become an adjunct to DBS operations, with both offering competition to cable and other media.

V. AN OVERALL ASSESSMENT

The analysis in Secs. III and IV suggests that DBS systems have greater potential for widespread competition with cable systems than do alternatives. Their potentially lower market entry and exit costs render them more of a competitive threat than second cable systems. The severe line-of-sight constraints on wireless cable systems, combined with their limited capacity, are handicaps to widespread market growth, although these systems may do well in some local markets. Unless C-band service offers programming that is attractive to some audiences, the market for new HSD terminals will probably disappear in response to low-cost and more aesthetically appealing DBS systems. Likewise, SMATV systems, limited to high-density housing complexes, will likely tie into successful DBS networks. A summary of the advantages and disadvantages of DBS relative to other systems is shown in Table 5.

However, we cannot conclude from this study alone that DBS *will* offer widespread competition to cable during the 1990s. Outcomes will depend on several interrelated factors:

- The cost of earth terminals with satisfactory performance. Especially important are the costs of incorporating digital video compression and signal access control.
- The tradeoff between antenna size and marketability, given that the smaller the antenna size, the smaller the aesthetic handicap—as well as manufacturing and other costs.
- The degree to which video compression reduces per-channel cost of the space segment. For a given number of channels offered to subscribers, video compression would permit use of fewer transponders (and satellites), thereby reducing up-front investment and risk. Alternatively, for a given number of transponders, video compression would permit a larger number of channels.
- The level of operating expenses including program acquisition costs. These costs depend in large measure on whether DBS systems will have access to programs under the same terms and conditions available to cable operators. Equality of access will depend, in part, on whether DBS systems can ensure signal security on a parity with cable systems.

Table 5

COMPARISON OF MODEL DBS TO ALTERNATIVE SYSTEMS

Advantages of DBS	Disadvantages of DBS
Compared to second cable	
Has greater flexibility in entering and exiting local markets	Requires outdoor antenna
Depending on degree of video compression, may offer more channels	Requires line of sight to satellite
May offer lower priced service	Carries few, if any, signals from local broadcasting stations
Could provide early nationwide broadcast of HDTV signals	Subject to outages during periods of heavy rainfall
No signal interruptions caused by amplifier or cable problems	
Compared to wireless cable	
Has greater elevation angles to transmitter	Requires more expensive user terminals
Depending on degree of video compression, may offer more channels	Subject to outages during periods of heavy rainfall
Could provide early nationwide broadcast of HDTV signals	Carries few, if any, signals from local broadcasting stations
Compared to SMATV and HSD	
Has smaller, lower-cost user terminals	Subject to outages during periods of heavy rainfall
No antenna repointing required	
Installation is easier	

- The extent to which market demands exist for channel capacity and services beyond those offered by cable systems. Critical here are (a) the amounts subscribers and advertisers are willing to pay for the additional programming (which will presumably cater to highly specialized tastes), and (b) the costs of acquiring the programming, marketing it to subscribers, and transmitting it from the point of origin to subscriber terminals.
- The extent to which DBS systems would be handicapped by carrying few, if any, signals of local broadcasting stations. The handicap depends on (a) the quality of over-the-air reception, which varies among geographical areas, and (b) the value that households place on locally originated programs, such as local news and sports.

VI. TECHNICAL CHARACTERISTICS OF DBS SYSTEMS

The preceding sections discussed technical and economic factors that will affect the relative competitive positions of cable, DBS, and other multichannel systems. This section explores in more technical detail three salient factors that bear on the future of DBS systems.

- Orbital positions and frequency assignments that determine the number of high-power DBS transponder channels available to the east and west portions of the country (including Hawaii and Alaska).
- Digital video compression techniques that will enable a multiplication of channels, as illustrated by specific DBS proposals noted above. We also explore possibilities that these techniques may have differential effects on DBS and other systems, thereby altering their relative competitive positions.
- Alternative approaches to coping with the problems of ensuring signal security, an obviously key factor for any service that requires subscriber payment. We also consider how signal security may differ between cable and DBS systems.

ORBITAL POSITIONS AND FREQUENCY ASSIGNMENTS

As discussed in Sec. II, consistent with international agreements for use of the BSS band, the FCC has assigned rights to spectrum use in eight orbital positions for domestic high-power DBS service. Each position has available 32 transponder channels, each with 24 MHz bandwidth. The minimum spacing between these DBS positions has been set at nine degrees, with each position allocated the full 500 MHz bandwidth available in the BSS band in each of two 16-channel polarizations.[1] One position (located over the Atlantic Ocean at 61.5 degrees W.L.) can easily provide service to the eastern portion of the United States only. Three orbital positions (101, 110, and 119 degrees W.L.) can provide service to the entire CONUS. Four positions (148, 157,

[1]In Region 2 (covering the Americas), and in addition to the United States, allocations of the full 500 MHz per orbital position have been made to Canada (at least five positions at 72.5, 82, 91, 129, and 138 degrees W.L.), Mexico (at least three slots at 78, 127, and 136 degrees W.L.), and Brazil (at least one position at 102 degrees W.L.). For many other countries, the frequency band is shared within one orbital position.

166, and 175 degrees W.L.) cannot provide service to the eastern half of the United States, while service to Alaska and Hawaii is reserved for two of these four (166 and 175 degrees W.L.).

The FCC has made its allocations in pairs, with the two 16-channel allocations per orbital position each given on a "half-CONUS" basis—i.e., with beam coverage over either the western or eastern half of the CONUS. For the three orbital locations that cover the whole CONUS, satellites are allowed to provide half-CONUS service to the eastern half of the United States or full-CONUS service to the entire country.[2]

The Regional Administrative Radio Conference (RARC) for Region 2 (the Americas)[3] has specified plans for the BSS band, of 17.3–17.8 GHz for the uplink and 12.2–12.7 GHz for the downlink. (The Ku-band FSS band is 14–14.5 GHz on the uplink and 11.7–12.2 GHz on the downlink.)

In both the BSS and FSS bands, two orthogonal polarizations are used to enable reuse of the spectrum. The allocation for the BSS band specifies the use of circular polarization to simplify antenna installation. With circular polarization the signal is either right-hand circularly polarized (RHCP) or left-hand circularly polarized (LHCP), and no polarization orientation of the antenna is required.[4]

The 1983 RARC polarization plan for each orbital position specifies 16 channels, each of 24 MHz, on each polarization. A given orbital position is described as an *orbital cluster* in which the two polarization assignments are located 0.2 degrees on each side from the center of the nominal longitude. The polarization assignments, then, are physically separated by 0.4 degrees and therefore in general cannot coexist on the

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[2]When some of these initial allocations were made in 1984, it was not anticipated that satellite powers would be high enough to allow full-CONUS coverage from one satellite. Partly for this reason, the FCC deemed all channel orbital allocations to be of equal value, thus avoiding the issue of comparative hearings normally necessary in situations where competing applicants request mutually exclusive facilities. As a result of escalating demand for DBS channels, the FCC refined its DBS allocations policy in 1989 by deciding to authorize DBS channels in east/west pairs. In this decision, the FCC affirmed its policy of orbital position equivalency. Further, the FCC conditionally authorized the provision of full-CONUS DBS service distribution subject to compliance with applicable international agreements. The FCC's view is that, should full-CONUS coverage prove technically feasible, it would be considered an optional use of the eastern half-CONUS assignment of the authorized east/west pair (Interview with George Fehlner, FCC Mass Media Bureau, October 10, 1990). See also FCC (1989), paras. 9 and 11.

[3]The agreements made during the 1983 RARC were later internationally codified during the 1985 and 1988 Space World Administrative Radio Conferences (WARCs).

[4]In contrast, the FSS band uses linear polarization, which generally means that the signal is either horizontally or vertically polarized as it leaves the satellite. Linear polarization requires careful alignment of the antenna during installation so that its orientation maximizes the desired signal and minimizes crosspolarization interference.

same satellite.[5] For example, the orbital position at 101 degrees would have two slots—one at 100.8 degrees for the 16 LHCP channels and another at 101.2 degrees for the 16 RHCP channels.

In principle, a single satellite could handle 16 channels with either polarization. But given current and prospective constraints on launch capabilities (higher total power would result in higher satellite weight), this would result in lower power per transponder than in our model DBS system which contains four satellites, each with eight transponders.[6]

The 0.4 degree separation between polarization assignments was specified by the RARC because it was regarded as wide enough to enable a feeder link (if one assumes that the uplink antenna has a sufficiently narrow beam) to spatially discriminate between the polarizations (i.e., between the separated satellites). At the same time, the 0.4 degree separation was narrow enough that on the downlink the wide beam of the receiving ground antennas would not be able to distinguish between the separated polarizations (i.e., the two would appear to be at the same location, and thus would not require repositioning of the ground antenna).

It is important to physically separate the polarization assignments, because the presence of rain causes some depolarization (a loss of polarization isolation) of the signal.[7] The narrow beam of the feeder uplink ensures that a signal intended for one polarization will not be coupled to frequencies on the other polarization. If this physical separation of the polarizations were not in place, some crosspolarization would occur during periods of rain that would create interference for *all* users of that orbital position. Of course, depolarization on the downlink can also occur, but this affects only users who reside in the area of rainfall.

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[5]However, the FCC has the authority under international agreement to relax the 0.4 degree separation requirement between polarizations within a domestic orbital cluster. For example, it might exercise this authority if the physical separation between polarizations can be shown to occur on the ground instead—i.e., if it can be demonstrated by the DBS licensee that the feeder link (uplink) locations are separated enough geographically (so that a satellite receive antenna pointed to that location would not pick up the signals from another feeder link location) and are on different polarizations such that crosspolarization is not a concern (interview with Steve Selwyn, FCC Mass Media Bureau, August 27, 1990). See also *Radio Regulations*, Appendix 30 (Orb-85), Annex 7, para. B.

[6]Advanced Communications Corporation plans to use 16 transponders per satellite at 180 watts per transponder (three-fourths the power per transponder of our model DBS system) (letter from Donald K. Dement, Novacom, Inc., November 16, 1990).

[7]The RARC channel frequency allocations are staggered between the two polarizations, with the odd channels using RHCP and the even channels using LHCP. The Channel 5 downlink at 12,270.32 to 12,294.32 MHz, for example, shares frequency spectrum with the Channel 6 downlink at 12,284.90 to 12,308.90 MHz. It is assumed that in this frequency reuse, sufficient polarization isolation can be maintained.

DIGITAL VIDEO COMPRESSION

The successful commercialization of digital video compression is of great importance to DBS systems because the prospect of a DBS system with a large number of channels available presents the possibility of DBS emerging as a widespread competitor to cable.

DBS Signal Format

The format of the DBS television signals must be made compatible with currently available television sets and video displays. If digital video compression is used, the IRD must provide for conversion from the multiplexed digital format, which would be transmitted by the satellite, to the NTSC format for the conventional receiver.

Other formats may be transmitted on some channels, if there are enough sets compatible with these formats to justify doing so. For example, it is likely that some channels will be allocated for the transmission of HDTV.

Compression Techniques

Digital video compression techniques are being developed to dramatically reduce the bandwidth required to transmit a television signal, allowing about three to 10 NTSC television signals or one or even two HDTV signals to be transmitted within the bandwidth that otherwise would be required to transmit just one (uncompressed) NTSC television signal. For these techniques to be used, however, the analog television signal must first be digitized, after which compression is used to reduce the number of bits needed to transmit the signal.

Each video signal consists of a frame (the series of horizontal lines that make up a picture), which is continuously being updated (for the NTSC signal, the rate is 30 frames per second). Both the spatial (image) and temporal (time) domains are candidates for compression. The overall video compression ratio is obtained by multiplying the compression ratio obtained in the spatial (image) domain with that obtained in the temporal (time) domain.[8]

Two general types of transform-based digital video compression techniques are currently vying for center stage: "discrete cosine transform" and "subband coding" (SBC). The level of compression

[8]The temporal domain may have no compression at all or, depending on the amount of compression desired, may use some sort of motion compensation. For example, it is possible to have good spatial but poor temporal compression. This can be seen in some video teleconferencing applications where the picture looks adequate but the motion is jerky.

made possible by these techniques depends on the original resolution of the signal. An HDTV signal, for example, can be compressed at a somewhat higher ratio before any degradation of the image becomes apparent than can the lower-resolution NTSC signal.

The Discrete Cosine Transform. The better-known of these compression techniques is the Discrete Cosine Transform (DCT), which forms the basis of the JPEG[9] and MPEG1[10] standards. It is used as the compression transform for the General Instruments DigiCipher System, the Compression Labs, Inc., algorithms used for videoconferencing and for the proposed SkyPix medium-power DBS service,[11] and the C-Cubed Microsystems compression/decompression chip.[12] In general these systems use the DCT in the spatial domain only and use some sort of motion compensation in the temporal domain.

The DCT method takes each frame and divides it into 8×8 pixel blocks, performing a two-dimensional DCT on each block. (The reason for using small blocks is to limit the calculation complexity involved in performing the transform.) The coefficients of the transform (these represent the video information) are then quantized; if eight bits are used, for example, then one out of $2^8 = 256$ levels can be used to characterize the coefficient. The number of bits needed is reduced by exploiting the characteristics of human visual perception to allow the use of lower levels of quantization (i.e., rougher approximations) for the higher-frequency components. Finally, these variably quantized coefficients are coded, using Huffman coding[13] and run-length coding,[14] to further reduce the number of bits needed.

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[9]The Joint Photographic Experts Group (JPEG) is a joint committee of the Consultative Committee on International Telephone and Telegraph (CCITT) and the International Standards Organization (ISO). The purpose of this committee is to establish a standard—which is nearly completed—for image compression to enable compatible transfer and storage of image data.

[10]The Motion Picture Experts Group (MPEG) is an ISO committee. It has nearly completed its standard for compressed video at bit rates below 1.5 Mbps, the MPEG1. As shown in the calculations for this section, such a bit rate can be considered too low for entertainment video applications. The committee will next begin work on MPEG2, the standard for compressed video at bit rates ranging from 1.5–10 Mbps, This second standard will be of more interest to those seeking a standard for the compression of entertainment video.

[11]"SkyPix Plans Compression DBS Pay-Per-View Service," *Satellite Business News*, Vol. 2, No. 14, July 11, 1990, p. 38.

[12]"Image Compression Reduced to a Single Chip," *Microprocessor Report*, March 7, 1990.

[13]Given a "finite source alphabet," the Huffman code, a variable-length code, works something like the Morse code in that the shortest codes correspond to the events of highest probability.

[14]Run length coding is used when the information does not change for a long length of coefficients, for example, in a scene of blue sky. Instead of individually sending the same coefficients repeatedly, something akin to "the next 72 coefficients are for blue" is sent. Fax machines use this coding technique, because most of what is sent is white.

Depending on how close the viewer is to the screen, and what the scene is, at very high levels of spatial compression the 8×8 pixel blocks are visible, producing an artifact known as "blocking."[15]

Subband Coding. These are global transforms that operate on the entire frame and therefore do not exhibit any blocking artifacts. Subband coding (SBC), as its name suggests, divides the initial band into a number of subbands (by the use of digital quadrature mirror filters). As with the DCT method, the characteristics of human visual perception are exploited to allow the use of fewer levels of quantization for the higher-frequency components (subbands, in this case) and thus to reduce the number of bits needed. The different subbands are then coded according to their frequency content, with the finest quantization being reserved for the lowest subband.

Subband coding methods are generally used for compression in the spatial domain. Nevertheless, it has been claimed that subband coding methods can be used also for compression in the temporal domain.[16]

Wavelets and subband coding with vector quantization are two variants of subband coding. The former uses a class of mathematical functions called *wavelets*. Aware, Inc., is developing a chip to implement compression based on this technique.[17] *Subband coding with vector quantization* is being studied by the Media Lab at MIT and Bell Communications Research (Bellcore) in Livingston, New Jersey. (Yet another form of subband coding has been used successfully in digital audio compression applications.)[18]

These various approaches illustrate the range of possibilities—and hence uncertainties—in this field. It remains to be seen which ones turn out to be most attractive (or which others may emerge). The tradeoffs involve cost, times to implement, and compression rates attainable with acceptable reception quality.

Tradeoffs Between Power and Bandwidth

In choosing a modulation scheme and the corresponding amount of bandwidth to allocate to a channel, a tradeoff exists between bandwidth and power. In general, amplitude modulation (AM) is used in a bandwidth-limited but power-abundant system, whereas frequency

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[15]One of the authors has noticed a tendency in herself and others that if the image is studied up close and the artifacts pointed out, they become more noticeable at a distance than they would be otherwise.

[16]"Video Compression Using 3D Wavelet Transforms," *Electronic Letters*, Vol. 26, No. 6, March 15, 1990, pp. 396–398.

[17]"Wavelets—Wave of the Future?" *The Boston Globe*, July 16, 1990, p. 20.

[18]See Consultative Committee on International Radio (1990).

modulation (FM) is used in a power-limited but bandwidth-abundant system.

In the early days of broadcast television, channel allocations were made and modulation schemes were chosen based on the fact that spectrum was scarce, while the transmitters, located relatively close to the television receivers, could provide high levels of power to television receivers. For these reasons the modulation scheme chosen for NTSC video was a form of amplitude modulation, vestigial sideband (VSB), which allowed a 6 MHz bandwidth to accommodate the full television signal.

The opposite situation pertained to satellite transmission of analog video signals. Spectrum at the microwave frequency bands was more abundant, but carrier power levels were extremely low at the receive terminal. Since the ratio of the received signal power to the noise received is the paramount consideration, attempts were made to keep receiver noise levels as low as possible. However, even with low noise levels, the signal-to-noise ratio was still much lower than in the case of terrestrial broadcast. The solution to raising the signal-to-noise ratio was to adopt wideband FM. But this approach required a sixfold increase in bandwidth relative to terrestrial channels—to 36 MHz for most satellite television channels.

The proposed Sky Cable, SkyPix, and other DBS systems that plan to use digital compression will transmit video as a digital bit stream, which generally necessitates use of some form of phase modulation (PM)—a relative of FM. Even though PM is generally power-efficient, the specific PM scheme chosen will depend on the desired combination of power and bit rate. For example, for a given channel bandwidth, Quadrature Phase Shift Keying (QPSK) requires twice the power but allows twice the bit rate as does Biphase Shift Keying (BPSK). Likewise, for a given channel bandwidth, an 8-ary signal requires nearly seven times the power but allows three times the bit rate as does BPSK.[19]

As stated above, to obtain high levels of compression of the video signal, it must first be converted from analog to digital. An advantage of digital transmission is that it can result in a virtually noise-free signal, since most errors generated during transmission can be corrected at the receiving end to a threshold at which any remaining noise is imperceptible to the viewer.[20] However, if the digitized signal is not

[19]For a more thorough explanation of the tradeoffs between power and bandwidth inherent in the modulation scheme chosen, see Whyte (1989).

[20]However, digital transmission, like analog, would be susceptible to rain fade, depending on the particular radio frequencies used. In general, the problem of rain fade increases as one moves to progressively higher frequencies.

compressed in some manner before being transmitted, it would require a larger bandwidth to transmit than would the original analog signal. It is for this reason that digitized video has not been generally used.

How Much Compression Is Feasible?

The bit rate required to transmit an uncompressed digitized broadcast NTSC signal is 76 Mbps. The bit rate required to transmit SMPTE 240 HDTV is nearly 10 times as much, about 720 Mbps.[21]

For a DBS system using QPSK as the modulation scheme, a bandwidth of 24 MHz allows a transmission of 40 Mbps per transponder. If a rate 3/4 error correcting code is used, 10 Mbps will be used for forward error correction (FEC) coding and 30 Mbps for transmitting the information.[22] It is clear from these numbers that, without some form of compression, digitized video (76 Mbps) could not be transmitted in real time within the available transponder bit rate (30 Mbps). The question regarding compression then becomes: How many compressed video signals can fit into a 30 Mbps bit stream?

It has been shown that, starting with 16 bits per (color) pixel, imperceptible degradation occurs with a spatial compression ratio of 10.67, which results in an average of 1.5 bits per pixel.[23] Since the uncompressed NTSC signal uses 12 bits per pixel,[24] this 10.67 compression ratio would correspond to an average of 1.125 bits per pixel. If one also assumes conservatively an average temporal compression of 2:1, the overall compression ratio (spatial times temporal) would be 21.33, resulting in an average of 0.5625 bits per pixel.[25]

A digitized NTSC broadcast television signal consists of 211,200 pix-

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[21]See the appendix for calculations of these bit rates. A General Instruments DigiCipher advertising brochure claims that 1.2 Gbps would be needed to transmit an uncompressed HDTV signal.

[22]These numbers are approximations and may change according to such factors as variations in EIRP and ground antenna size (interview with Andrew Strodtbeck, Hughes Aircraft Company, August 16, 1990).

[23]According to one report "at about 1.5 bits per pixel or less the images are essentially indistinguishable from the original source images" (Mitchell et al., no date, pp. 82–83).

[24]See the appendix.

[25]Much of the information for the calculations in this section was obtained during interviews with Donald Mead, Hughes Aircraft Company, Summer 1990. These calculations represent some of the numbers that might be used for digital video compression in a high-power DBS system. Different compression algorithms and ratios in both the spatial and temporal domains can have significantly different performance and cost. Final numbers await extensive subjective viewing tests comparing candidate algorithms at different degrees of compression.

els per frame.[26] The average bit rate required to transmit the compressed video signal is therefore

211,200 pixels × 30 frames/sec × 0.5636 bits/pixel = 3.56 Mbps

Next, we must determine how much to compress the audio signal, and the corresponding bit rate required to transmit it. It has been shown[27] that compact-disc (CD) quality audio can be obtained using compression that results in a bit rate of 96 Kbps. Multiplying by two for stereo[28] results in a bit rate of 192 Kbps to transmit compressed stereo CD-quality audio on each DBS channel.

Thus, the total bit rate required to transmit the compressed video and audio amounts to an *average* of 3.75 Mbps for each compressed NTSC channel.[29] At 30 Mbps for each high-power DBS transponder, eight NTSC television channels could fit into each DBS transponder.[30]

A different number may apply for those proposed *medium-power* DBS systems that intend to use digital compression techniques. The medium-power systems will use existing Ku-band FSS satellites which, despite having wider transponder bandwidths, have considerably lower satellite EIRPs—resulting in an information bit rate for each transponder channel that will generally be lower than that of the high-power DBS systems.

In one case at least, the number of channels per transponder is the same as shown here but the amount of compression is greater because of the FSS satellite power limitation coupled with the DBS operator's desire to use fairly small subscriber antennas. SkyPix Corporation, which has announced that it will begin offering an 80-channel DBS service in early 1991 using an existing Ku-band FSS satellite, has stated that it will use digital compression techniques to transmit eight

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[26]An NTSC signal has 525 horizontal lines, about 480 of which are active, for each frame. The aspect ratio (width to height) of an NTSC signal is 4:3, which should give a pixel-equivalent of 480 (4/3) = 640 pixels in the horizontal direction. However, for broadcast television the horizontal resolution is less, in effect "stretching" the pixels in the horizontal direction so that there are 440 instead of 640 pixels on each horizontal line. Therefore, the total number of pixels per frame can be calculated as 480 lines/frame × 440 pixels/line = 211,200 pixels per frame.

[27]See Consultative Committee on International Radio (1990).

[28]Some experts contend that it is sufficient to multiply the monochannel rate by 1.5 to obtain high-quality stereo (see Johnston, 1989).

[29]The actual number of bits needed per channel may vary according to the complexity of the scene and type of motion. *Adaptive multiplexing* can enable the bits per individual channel to increase or decrease while the total number of bits per transponder remains constant.

[30]Thus, in our model DBS system, 32 transponder channels would yield 256 NTSC channels.

channels through one transponder.[31] To provide this service, SkyPix has leased 10 transponders on SBS-6, a Ku-band FSS satellite having 41 watts per transponder. To obtain the proposed 8:1 channel multiplication ratio, Compression Labs, Inc. (CLI) has reportedly developed a compression algorithm for SkyPix that will compress the composite (i.e., includes audio) video signal down to 2 Mbps.[32] It is reasonable to assume that this compressed composite video signal includes roughly 200 KHz for stereo audio, leaving 1.8 Mbps for the video alone.

Recall that our earlier calculations showed that a composite video signal compressed to 3.75 Mbps (the video alone compressed to roughly 3.6 Mbps) would allow eight channels to be transmitted through one high-power DBS transponder. The 1.8 Mbps compressed video to be used by SkyPix indicates that to achieve a channel multiplication ratio of 8:1 in the medium-power case requires twice the compression as that of the high-power case at 3.6 Mbps. This means that if the SkyPix compressed composite video at 2 Mbps were transmitted through a high-power DBS transponder rather than a medium-power DBS transponder, a 15:1 channel multiplication ratio could be obtained.

Compression for Terrestrial Broadcasts

The DigiCipher System advertises that it can transmit five NTSC channels within one terrestrial 6 MHz bandwidth and 10 programming channels in an NTSC format within one satellite transponder.[33] To understand why the DigiCipher compression system can squeeze twice as many televisions channels into a satellite transponder as it can into a terrestrial broadcast channel or cable channel, two factors must be considered. First, the bandwidth ratio of a high-power DBS channel (full transponder) to a terrestrial broadcast television channel is 24/6 = 4:1. Second, the 16-QAM (Quadrature Amplitude Modulation, a combination of phase and amplitude modulation) used by DigiCipher to modulate the terrestrial signal can provide twice as many bits/sec per unit bandwidth as can the QPSK used by DigiCipher to modulate the satellite signal.[34] These two factors together mean that DigiCipher, by the use of QPSK, can obtain twice as many bits per high-power DBS

[31]"Moving Up the Timetable on DBS," *Broadcasting*, Vol. 119, No. 8, August 20, 1990, pp. 27–28.

[32]"Network Satellite Compression Drawing Nearer," *Broadcasting*, September 10, 1990, Vol. 8, No. 11, pp. 87–88. See also "SkyPix, Comsat Sign Memorandum," *Satellite Business News*, Vol. 2, No. 23, October 31, 1990, p. 21.

[33]Advertising brochure distributed by General Instrument's VideoCipher Division at SBCA Convention, Nashville, July 9–11, 1990.

[34]Information regarding the modulation schemes used by the DigiCipher system was obtained from General Instrument Corporation (1990).

channel as the 16-QAM can provide in the 6 MHz terrestrial broadcast or cable channel. Thus, when the same digital compression ratios are used, *compression favors the high-power DBS channel over the terrestrial channel by a factor of about 2:1.*

Applications of Digital Compression

Digital compression techniques could be used by a variety of transmission systems. In all cases, use of digital compression would require that the consumer have electronic equipment (generally some sort of IRD-like unit) that can put the digitized, compressed signal back into a form compatible with NTSC television sets (and later with HDTV sets).

Because of the millions of existing television sets, it is not likely that over-the-air broadcast NTSC television will be digitized and compressed. To receive such signals would require a set-top converter. Households that could not afford to purchase the additional unit would no longer be able to receive signals being transmitted on the public airwaves.

In contrast, digital compression is an attractive candidate for over-the-air broadcasts of HDTV, because such future sets could be built from the start to accept digitized, compressed signals.[35]

For cable, wireless cable, and DBS systems, subscribers have already made an investment in additional units and pay to receive signals. For these viewers, the tradeoffs between additional cost and additional channels may make the use of digital compression attractive.

With digital compression techniques, wireless cable could multiply the number of channels available by a factor of about three to five, depending on the level of degradation to picture quality acceptable to viewers.[36] However, doing so before such technologies mature requires a substantial investment in receiver equipment[37] that, with its limited market penetration, may not prove economically attractive.

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[35]Responding to rapid developments in digital video compression technology, several proponents of alternative HDTV terrestrial broadcast systems are modifying their proposals to incorporate digital video compression to squeeze an HDTV signal into a 6 MHz bandwidth. These alternatives are to be evaluated by the FCC, with its final decision expected in 1993. For a brief discussion see "Advanced TV Testing Set Amid Tumult over System," *New York Times*, November 15, 1990, p. C-1.

[36]Estimate based on 2:1 factor for 24 MHz channel and 6 MHz channel multiplication ratios discussed above.

[37]Today's wireless cable terminal equipment is fairly simple, primarily consisting of an antenna mounted on the roof and a downconverter to convert the S-band signals at 2 GHz to VHF. The use of digital compression would require the development of an IRD unit which at the very least would have to demultiplex, decompress, and reconvert the digital bit stream back to an analog NTSC format.

A DBS system would draw from a larger nationwide market, justifying development of a more complex IRD than those currently available. In addition to demodulating and descrambling the signal, this more complex IRD must also correct errors, demultiplex, decompress, and reconvert the digital signal to an analog NTSC format.

SIGNAL SECURITY

All signal providers who charge a fee for their services are concerned with security. If security is compromised for a large number of users, considerable revenue will be lost, since these users avoid payment for the service. Under these circumstances the program suppliers will want to take their program supply elsewhere.

Good security will be the sine qua non of any DBS business. The problem is not the individual pirates here and there who circumvent the system, but pirates who defeat the security system and then sell their secret to many others. Here we discuss the dimensions of the security problem.

Incentives to Piracy

VideoCipher II (VCII), the mainstay of cable scrambling, has been heavily pirated by backyard satellite dish owners who own illegally modified or "black-market" VCII decoders. With a pirated decoder, as opposed to an authorized decoder, the user is not billed for the descrambled programming.[38] One way in which the system was broken was by hackers who were able to clone a particular decoder's key, which was built into the decoder. This key was then duplicated in hundreds of other decoder boxes, allowing all pirated decoders program access when the system thought it was giving such access to only the one original decoder. The pirates sold these decoders at a much cheaper price than the monthly service charge to obtain the programming legally.

To remove this incentive, any new service must seek to make the cost of illegal service greater than the cost of legal service. As an additional hedge, it must be assumed a priori that no system is perfectly secure, that someone will figure out a way to circumvent even the most elaborate security system. Therefore, means should be available to regularly update the security system.[39]

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[38]According to one source, users of over 50 percent of the VCII decoders in the field are not paying for programming (Howes, 1990).

[39]VideoCipher II Plus, the replacement for VCII, is designed to enable it to evolve as new threats of compromise evolve (phone conversation with Harry Thibedeau, Director of Broadcasting and Media Sales, SBCA, August 13, 1990).

Conditional Access

Conditional access means just that—that certain conditions must first be satisfied before access to the signal is granted. First, users must have signed up for the service and paid their bills. Second, if access is granted on an individual channel basis, the users must not be geographically located in a "local blackout" area for that particular channel.[40] This type of access can be contrasted with free access, such as that available with over-the-air terrestrial broadcast.

Once these conditions are satisfied, access is granted to the authorized decoders through the "key," which unlocks the algorithm for descrambling the signal.

The Key

The primary weakness in any encryption system resides in the method used to distribute the key (also known as the "control word") rather than the encryption algorithm itself.[41] The key can be stored in the decoder, in a "smart card," or can be transmitted from the satellite. If the key is stored in the decoder, it is imperative to prevent the widespread cloning of an authorized decoder. Preventive steps can be taken, such as prohibiting the manufacture of duplicate keys and using decoder chips whose logic self-destructs when any attempt is made to reverse-engineer the chip. The use of a "smart card" to store the key is probably too cumbersome if the card must be updated or a new card mailed out frequently.[42]

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[40]A local blackout arises when no decoders in a specified area are authorized to descramble the channel. An example is a televised local sports event for which all tickets have not been sold. As an alternative to local blackout, the sports franchisee could charge a higher pay-per-view fee (comparable to or greater than the cost of a ticket) to local viewers than to viewers outside the local area.

[41]Howes (1990), p. 29.

[42]In Great Britain, Sky Television employs a "smart card" in its Videocrypt security system. The original plan called for a new card to be mailed periodically to each subscriber, perhaps monthly. However, because the manufacturing and administrative costs of frequently replacing the card were prohibitive, the plan was revised, with cards to be replaced less frequently. In light of the Sky Television experience, smart card technology would probably be employed for a nationwide DBS system in the United States only if the cards are replaced infrequently—perhaps only once every year or so, in the same way that credit cards are replaced.

Billing for Pay-per-View Service

A successful pay-per-view (PPV) authorization system should satisfy two criteria: It should be speedy and it should be able to accommodate impulse buys, or what is known as *impulse pay-per-view* (IPPV). To determine how these criteria can be met, the system for billing must be considered.

Essentially two methods could be used to bill for DBS service—the *phone company billing method* and the *cable company billing method*. In both cases, a basic monthly service fee is levied. In addition, a monthly subscription fee might be added for additional programming. The difference between these two billing methods comes into play when service such as PPV is desired.

Using the telephone company billing method, all PPV programs could be authorized for one month, in the same manner that all long distance calls are authorized for at least one month. If a subscription channel had not earlier been subscribed to, its programs could nevertheless be viewed on a higher-charge IPPV basis.[43] If the customer does not pay the bill at the end of the month, then subsequent authorization for all such programming could be denied. Clearly, this method would meet the criteria for speedy authorization and for accommodating IPPV.

Using the cable company billing method, each PPV program could be authorized separately and *before* viewing. In essence, this means that a reservation is made before the program is broadcast. Meeting the criteria listed above becomes more problematic under these conditions.

Aside from the subscription channels, to ensure that bills will be paid requires some kind of *feedback*, an accurate and secure record of what pay-per-view channels have been played on the set. Since it obviously cannot rely on an honor system, this feedback should be automatic. This record can be automatically delivered to the business center via phone lines (a modem connected to the public switched telephone network), mail (perhaps an automatic coded printout from the IRD that would then be mailed by the viewer to the DBS business center), or by satellite return link. With an authorized decoder, it is imperative that no one be able to tamper with this feedback link so as to fool the system into thinking that no pay-per-view channels have been watched. For example, if a decoder were cloned, authorization for the original decoder would also authorize all its clones. The system, not knowing about the cloned decoders, would expect to receive feedback only from the original.

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[43]Parental control could be exercised by "locking out" certain channels at the IRD unit.

Prospects for Improved Security

Today's video encryption methods have entailed encryption of analog signals. For such an analog-based encryption system, it is difficult to get a "hard scramble," i.e., a signal unrecognizable in its encrypted form. Some of the more secure methods cut and slice each line and transpose the line segments in a random sequence. However, this approach is expensive. The cheaper and less-secure methods generally interfere with the video synchronization signals.

If the video signal is digitized before transmission, the method for scrambling the signal will be different from that used for an analog signal. To scramble a digitized video signal, the bits are relatively easy to manipulate. For example, the bit stream can be multiplied with a random sequence, as is done with the Data Encryption Standard (DES) algorithm.

If digital compression is used, the signal is to some extent already scrambled, since the IRD must include extensive digital processing to decompress the signal and reconvert it to an analog format. Nonetheless, if the transmitted signal were encrypted, it would not add much more in the way of digital processing to also descramble the signal. A custom-designed very large scale integrated (VLSI) chip could handle one or both of these functions. The price of such chips, along with the price of the IRD housing them, would drop as the DBS market grows.[44]

Comparison of DBS and Cable Signal Security

Digitizing the signal opens the door to enhanced signal security. The signal is inherently easier to scramble and virtually impossible to unscramble without access to the key. In contrast, many analog encryption schemes have been defeated even by those who do not have the key. Digital transmission is also advantageous because encryption and decryption do not degrade the signal, whereas present analog techniques cause some degradation.[45] Thus digital-based DBS systems will be benefited by an inherently more secure encryption scheme than will analog-based cable systems.

However, signal security rests on more than the encryption method used to scramble the signal. First, as noted above, concern regarding

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[44]According to one report, staff of the Intel Corporation calculate that "by the year 2000 a silicon chip will contain 100 million transistors and perform 2 billion operations per second running at 250 megahertz." By 1993 "Intel hopes to reduce all basic PC functions to one chip." "Intel says big chips are coming," *Communications Week*, July 9, 1990. It is such reports as this that lend optimism to prospects for future advances, on top of the dramatic advances of the past.

[45]For a discussion of the merits of digital encryption, see Apple (1990).

signal security rests primarily with the ability to collect revenue from those viewing subscription channels or PPV. Implementing a secure conditional access scheme and providing accurate feedback are crucial components to addressing this concern. If a higher proportion of total DBS revenues comes from subscription or PPV services than is the case for cable revenues, signal security will pose a more serious concern for DBS systems than for cable systems.

Second, the fundamental difference in transmission medium between wireline (cable) and nonwireline (satellite, wireless cable) systems results in differing means to implement signal security. In cable systems, a common technique is to use filters in the lines going to the individual homes to prevent unauthorized viewers from viewing subscription channels. In contrast, the entire spectrum of signals radiated by a satellite or wireless cable system arrives uniformly to all user terminals. For nonwireline systems, preventing unauthorized access to the signal is more difficult than in the case of cable systems.[46] For example, filters—located outside the home—can be physically checked for tampering with a cable system.[47] In contrast, interception of an unauthorized signal in a nonwireline system is less intrusive, which makes policing more difficult.

In summary, it is easier to design a more secure encryption algorithm for a digital-based DBS system than for an analog-based cable system. On the other hand, the consequences of a breakdown in signal security are more serious for a DBS system. On balance, whether a DBS system will be more secure than a cable system remains an open question.

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[46]This greater difficulty with nonwireline systems is of concern to some program suppliers as well. See the discussion of program access in Sec. VII. We note also that widespread pirating of cable signals began with interception of the *nonwireline* portion of the transmission—i.e., by HSD terminals receiving satellite transmissions intended solely for the cable headends.

[47]*Who* performs the checking in this case is important. The weakest link in signal security may be unethical behavior on the part of some employees who provide cable servicing. An unnamed source reports that, for some neighborhoods in his community, a cable serviceperson collects money on the side by linking noncable households to an existing cable household and its subscription channels. Whether this is an isolated incident or represents a widespread practice is not known.

VII. PUBLIC POLICY ISSUES

The preceding analysis described the economic and technical conditions under which DBS would be in a position to widely compete with cable systems. The future of DBS systems will depend also on how two issues of public policy are resolved: (a) the possibility of anticompetitive behavior by program suppliers in providing access by DBS systems, and (b) the possibility of anticompetitive behavior posed by crossownership between cable and DBS systems. Moreover, if widespread competition between DBS and cable systems *does* emerge, the consequences would raise four other issues of public concern: (a) the effects on local broadcasting, (b) the effects on program diversity, (c) the status of DBS systems either as common carriers or private carriers, and (d) modifications in cable franchise obligations and in the process of allocating radio spectrum to alternative uses. This section addresses both sets of issues.

ACCESS TO PROGRAMMING

In our comparative cost analysis, we have assumed that DBS systems have the same access to programming as do cable operators—that is, they pay the same amount per subscriber for comparable programs. However, a key concern for DBS is that wireless cable and SMATV systems, in many instances, are required to pay more for programming than are cable systems. Many assert that cable operators are able to impede competition by denying programming to alternative media, either because of exclusivity contracts with program producers or by cable ownership in program production.[1]

Concerns continue to be expressed before the FCC and elsewhere about program access that is free of anticompetitive pressures. Charges and countercharges are being made about whether program access is being used as an anticompetitive tool. A key element of

[1]Economists and lawyers have long been concerned with the anticompetitive effects that can arise from certain types of exclusivity contracts. Under certain conditions, such contracts "can have the effect of raising rivals' costs by restraining the supply of inputs available to rivals, thereby giving the purchaser power to raise prices in its output market" (Krattenmaker and Salop, 1986, p. 224). For several reasons, raising rivals' costs is a more attractive anticompetitive strategy for the firm than predatory pricing, as described by Salop and Scheffman (1983).

Congressional legislation has been the requirement that programming be made available on a "fair and equitable" basis to competing media.[2]

This legislative activity has been triggered by the large differences paid for the same programs by cable operators and by operators of media that compete with cable. As reported by the FCC, wireless cable operators pay 36 percent to 79 percent more per subscriber than do cable operators for six cable network services.[3] SMATV systems pay a per-subscriber premium of $2.25 and $2.64 per month for HBO and Showtime, respectively, over the rates reportedly paid by one cable MSO.[4]

At the same time, the fact that other media pay more than do cable operators does not constitute sufficient evidence of anticompetitive conduct. Differences in programming cost and other considerations may also play a role. With respect to SMATV and wireless cable, for example, the Disney Channel has stated that per-subscriber wholesale rates are slightly higher than cable operator wholesale rates "to account for higher administrative and marketing costs, bad debts, and problems with signal security." ESPN does not license programming to some wireless cable operators "because of problems relating to signal theft, financial stability and distribution capabilities."[5]

We cannot determine here whether differentials in program charges reflect differences in cost, as suggested by the above examples. (If so, we would regard these prices as "fair and equitable" by contributing to economically efficient outcomes.) But we can examine briefly the effects of such differences on potential competition between DBS and cable systems. To start, we note that cable operators paid $985 million for basic cable programming in 1989—an average of $20 per subscriber for 50 million subscribers.[6] If DBS operators were to pay an average premium of, say, 50 percent (based on the spread reported above), this differential would run to $10 per subscriber per year. Suppose further, that the average expenditure per subscriber for pay channels is the equivalent of one pay movie channel involving a monthly premium of $2.45 (which is the average of the $2.25 and the $2.64 figures reported above). The total annual premium would run to about $39—a

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[2]For a discussion of 1990 legislative action in the U.S. Senate and House of Representatives, see *Broadcasting*, July 2, 1990, pp. 19–21; and July 30, 1990, pp. 27–29 and pp. 73–74.

[3]FCC (1990b), Appendix G, Table XI.

[4]FCC (1990b), Appendix G, Table XII.

[5]FCC (1990b), footnote 179. These examples of programmers' wariness about the signal security of nonwireline systems illustrate the concerns noted in Sec. VI about the technical considerations of ensuring adequate signal security.

[6]FCC (1990b), para. 3.

nontrivial amount when compared with our annualized DBS costs in Fig. 1. This amount is equivalent to increasing the user terminal cost by about $190. This disparity in program access payments would make DBS substantially less attractive relative to the copper/fiber cable alternative.

Finally, we note that one argument for permitting large vertically integrated cable companies to own DBS systems is that they will help to ensure access to programming. If their ownership did facilitate access, the situation would constitute worrisome evidence of anticompetitive behavior in program supply. If program production and access are competitive activities, it should make no difference with respect to program access whether cable operators own DBS systems. Only if the cable operators in question own or control enough program production to substantially reduce competition would their participation in DBS affect the availability of programming to DBS. In such a case, government agencies should press for remedial measures.

Because of the possibilities of anticompetitive behavior, the FCC and Congress are concerned about issues of program access. The success of DBS, as well as other multichannel media, may hinge on how these issues are resolved.

CROSSOWNERSHIP

Today, cable operators are free to participate in DBS activities, and some are doing so. For example, nine of the 10 partners in the K Prime Partners venture, and one of the four partners in the proposed Sky Cable venture, are cable operators. Do such crossownership arrangements pose the threat of being used anticompetitively to protect investments in cable? Several U.S. Senators emphasize that "we are concerned that a DBS business which is dominated by the large vertically integrated cable companies will never emerge as a competitive alternative to cable at the local level."[7]

Our preliminary analysis suggests that the dangers associated with crossownership may be less in the DBS field than might be supposed. We have difficulty constructing scenarios within which cable operators can forestall competition with their cable systems through their ownership of DBS systems, without their taking a good deal of financial risk. This situation arises because (a) rapid technological advance in this field, combined with the amount of spectrum available in both the FSS Ku-band and BSS Ku-band for DBS use, will encourage competitive

[7]Letter to James Rill, Assistant Attorney General, Department of Justice, from Senators Metzenbaum, Gore, Specter, and Lieberman, May 9, 1990.

entry, and (b) cable companies that pursue this strategy will bear all the costs but will confer benefits on other cable companies that are thereby sheltered from effective DBS competition. We have constructed two scenarios—both of which involve high risks—to illustrate the problems that cable operators would face trying to deny the use of DBS technology to those who would compete with their cable systems.

Preemptive Anticompetitive Entry

Consider a DBS system—system "A" wholly owned by one or more cable operators. The system consists of type "A" satellites used with type "A" user terminals. The cable operators invest in the system hoping that by being first they can creamskim the DBS market and deter, or at least postpone, subsequent DBS entry by competitors. This activity attracts those households most likely to subscribe to DBS: those not passed by cable, those served by obsolete, low-capacity cable systems, and those served by high-cost cable systems in areas of low housing density. Most notably, this market excludes homes served by modern high-capacity cable systems because the DBS technologies underlying system A—which we assume are the best available at the time system A is launched—involve few channels or expensive user terminals. The cable operators hope that by moving first with DBS, they will deter entry of a subsequent noncable-owned DBS system that, with lower costs and higher capacity, *would* compete head on with their cable systems. The cable owners reason that, although not enough households will subscribe to enable the owners to recover their full investment, the net loss will be more than offset by the protection of their cable systems afforded by forestalling competition from other DBS systems.

To illustrate this deterrent strategy, consider a second DBS system—"B"—available a few years after A, and owned by noncable interests. It incorporates more advanced technology than in type A satellites and type A user terminals, posing a serious competitive threat to cable systems. However, the most likely households for DBS service have already procured type A terminals to work with the A system. With this segment of the potential market locked into system A, the prospects for system B are less favorable than otherwise. Lacking this strong initial boost from selling to the most likely subscribers, implementation of system B may be delayed into the indefinite future.[8]

[8]For example, system B might proceed when its costs, including user terminal costs, are low enough that users of type A terminals are willing to discard them in favor of switching to the B system. The owners of system B may be willing to take losses on the operation of system B, by keeping prices low, as a predatory pricing strategy. This situa-

However, this deterrent strategy is risky because its success depends critically upon the time lag between implementation of the two systems and the expectations of potential users. To illustrate, suppose that the cable operators of system A estimate that three years will elapse between initiation of system A and the time that system B would have been initiated in the absence of system A. They reason that a three-year head start would be enough to entrench themselves so that planners of system B will be deterred from proceeding at the end of that three-year period.

It is easy to show how these expectations could be upset. Suppose that the cable operators of system A subsequently face unexpected technological or business snags that delay its implementation. Or suppose that technology breakthroughs permit implementation of system B more quickly than expected. In such cases, a time lapse of only one or two years might be involved. In such a short time, system A may not be entrenched enough to deter owners of system B from proceeding. In this case, the system A operators take a greater loss than they had anticipated and they fail to forestall competition with their cable systems. They would end up being worse off than if they had not invested in system A.

Next, consider the case where cable operators correctly predict the three-year head start but fail to anticipate the "announcement" effect of system B. Even though system B is three years away, potential users might foresee that system B will be deployed. These anticipations are strengthened by the owners of prospective system B describing (undoubtedly in glowing terms) their system's benefits—greater channel capacity, lower terminal costs, and smaller antennas—compared to system A. In response, some households that otherwise would have procured type A terminals will wait for the type B system. Again, system A's market penetration is lower than expected, the entry of system B proceeds as scheduled, and the cable owners of system A suffer losses as described above.

Another possibility is that households procure type A terminals as anticipated by the owners of system A, but the terminals can be retrofitted to work with system B. In this case, households can easily afford to switch to system B. When system B becomes operational, system A loses much or all of its market.

As a variant of the preceding scenario, system A offers space segment services and the user terminal as a bundled service, perhaps as a

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tion is similar to that described by Farrell and Saloner (1986, p. 943) "One weapon [the incumbent monopolist] can deploy . . . is to engage in temporary price reductions, thus keeping his competition at bay, until his proprietary technology has so large an installed base that incompatible competitive entry becomes impossible."

way of encouraging more rapid subscriber growth than would be likely with unbundled service. However, the consequences for A's owners could be even worse than with unbundled service. Subscribers to A's service could cancel service and transfer to B, leaving the owners of system A with discarded type A terminals whose costs have not been recovered.

Extension of Crossownership

Suppose that the cable operators who own system A also own system B. This extension of crossownership from A to B does not eliminate the problem of covering total costs. Again, system B would cover its costs only if it competes head on with cable—all the more so given that system A has a three-year head start in creamskimming the market. In response, the owners of system B may seek to compete vigorously only with *outside* cable operators. In this case, system B would have (a) one schedule of space segment charges for users of type B terminals in the franchise areas served by other cable operators, and (b) another *higher* schedule of space segment charges for users of type B terminals within the franchise areas served by the cable operators who own system B, thus protecting their cable investments.

However, such discriminatory space segment charges would surely trigger public outcry; and the FCC and the Department of Justice would be under pressure to move quickly. With nondiscriminatory treatment forced by government action, the cable operators of system B would face (a) losses in operating system B if they refrain from head on competition with their cable systems, (b) losses on their cable systems if they permit competition from system B, or (c) some combination of DBS and cable losses, depending on how the owners adjust their space segment charges. Moreover, the owners of system B would suffer losses on system A, as described above.

The Need for Further Analysis

Crossownership is not necessarily a serious issue. The reader may devise anticompetitive scenarios that are more plausible than ours. Moreover, even in the absence of anticompetitive behavior, issues arise as to whether the information gatekeepers for cable should be the same as those for DBS, in light of First Amendment concerns and the goal of encouraging program diversity.

In any event, the crossownership issue deserves early investigation by the FCC and the Department of Justice. Relevant to that investigation is the fact that, until recently, cable operators were free to buy

into wireless cable systems within their franchise areas, and some have done so. Because of concerns similar to those illustrated above, the FCC has decided, on the basis of a recent inquiry, to impose a general ban on crossownership between cable and wireless cable systems within common service territories. The Commission currently has an inquiry under way into whether existing crossownership arrangements should be permitted to remain.[9]

The Commission should undertake a similar inquiry for DBS.[10] Among the issues for investigation is whether *all* participation by cable operators in ownership of DBS systems should be prohibited, or whether participation up to a specified percentage share of ownership should be permitted. The longer the FCC and other government agencies postpone consideration of the DBS crossownership issue, the harder it will be to undo arrangements for ventures already under way (if these arrangements were found not to be in the public interest). Moreover, an early FCC and antitrust determination would reduce the uncertainty future ventures face by giving participants a clearer idea of which ownership arrangements would withstand subsequent government scrutiny.

With this analysis of issues that affect the future of DBS now completed, we turn to policy issues that would become relevant if widespread competition between DBS and cable systems emerges.

EFFECTS ON LOCAL BROADCASTING

As noted above, a salient characteristic of DBS systems with nationwide beams is that they will carry few, if any, local broadcasting signals. DBS subscribers (without cable) would depend on over-the-air reception of local signals.[11] In areas where over-the-air reception is good, subscribers would have rooftop VHF/UHF antennas, perhaps alongside their DBS dishes. In areas of poorer reception, local broadcasting might be adversely affected by substitution of DBS service for cable in many households. The high-quality reception by DBS of national and regional programming would draw viewing away from local stations with lower-quality reception. In areas where reception of

[9]FCC (1990d).

[10]For an analysis of the FCC's crossownership rules in the electronic media, see Besen and Johnson (1984).

[11]Of course, increased capacity and the use of spot beams may permit DBS systems to carry a number of local signals. But it would be very expensive to do so, at least during the 1990s.

local stations is poor, signals from broadcasting stations carried on cable would be unavailable to DBS subscribers.[12]

In such cases, audiences of local stations would shrink and concerns would mount about the long-term viability of these stations. One possible response is for local stations to expand the role for which they are uniquely qualified—offering local programming. Whether a market exists for expanded over-the-air local programming remains an open question.

Such questions have also arisen in the case of cable television. An argument, heard especially during the 1970s, was that cable carriage of signals from distant broadcasting stations would fragment the audiences of local broadcasting stations, possibly leading to these stations' demise and putting into jeopardy the availability of "free" over-the-air broadcasting. These adverse effects have been mitigated, however, because cable also carries the local signals. Indeed, some stations (especially UHF stations) have benefited by cable carriage, which increases their reach by improving their reception.

If DBS attracts significant numbers of subscribers from cable, or if cable systems begin to be abandoned, similar arguments will arise. Consider the situation faced by the Public Broadcasting Service (PBS), which is supported in part by federal funding through the Corporation for Public Broadcasting. Concerns about the future of local public broadcasting have already been raised because of the increasing amount of competing cultural and educational programming available on cable networks. This problem could become even more serious with DBS systems, because they could carry the same cultural and educational programming available on cable networks, *without* any offsetting benefit to *local* PBS stations from their signals being carried locally. If local PBS stations' audiences were eroded enough, these stations might go off the air. If so, households dependent on over-the-air service would lose both nationally oriented and locally oriented cultural and educational programming provided today by local PBS stations.

At the same time, regional public "superstations," similar to today's commercial superstations, might emerge that would serve large metropolitan off-air audiences, while being carried on DBS systems. Perhaps an even larger variety of national and regional public service programming would be available to DBS subscribers than is now available either off-air or on cable systems. A key question is whether the level

[12]To be sure, some households might subscribe to both cable and DBS. In effect, the household would be subscribing to cable to view locally broadcast programs. A household's purchase of services from both media would be widely attractive only if the "basic" cable service tier (consisting mostly of local signals) were priced very low by the cable operator.

of voluntary subscriber contributions, currently made to local PBS stations, would continue in response to a shift toward regional and national programming.[13]

Local commercial stations would face similar issues, especially if local news coverage on these stations to households dependent upon over-the-air reception were reduced or eliminated.

More generally, widespread growth of DBS would increase the per-viewer cost of locally originated programming—local news, local sports, or other coverage of interest primarily to local audiences. This outcome would run contrary to the goal of promoting "localism" that for decades has helped guide FCC policy toward broadcasting.

Whether the goal of localism continues to be worth pursuing involves analysis beyond the scope of this study. Our purpose here is only to suggest that DBS, if successful, could make localism more difficult to maintain in television programming. If localism is deemed to be of social value not well taken into account by market forces, specific external support may be warranted. For example, greater taxpayer support of local PBS stations may be needed, if this service is to be maintained at its present level of geographical coverage and program quality.

PROGRAM DIVERSITY

What are the likely effects of DBS on program diversity? To answer this question, it is important to distinguish between two categories of diversity, *expanded access* and *additional programming.*

The first involves diversity afforded by new technologies and other means that expand access to *existing* programming.

- *Reduced costs to the viewer.* For example, competition between DBS and cable systems would reduce prices paid by subscribers, thereby facilitating access. Households that would otherwise not subscribe to multichannel service would especially benefit. Another example is the emergence of a technology such as video compression that, used either in cable networks or DBS systems, may reduce per-channel costs and prices paid by subscribers.
- *Increased convenience to the viewer.* A prime example is the development of videocassette technologies that permit taping

[13]In 1987, subscribers contributed 21 percent of public broadcasting revenue, compared to 15 percent by the Corporation for Public Broadcasting and 19 percent by private businesses and foundations. The remainder came largely from government sources and academic institutions (Corporation for Public Broadcasting, 1989, p. 15).

and delayed playback. Another is a cable channel that covers live sports and entertainment events that would be very difficult for the viewer to attend in person. More generally, the much greater number of channels on cable than is available over the air permits easier access to the existing inventory of programs.

The second avenue toward increased diversity is the production of additional programming. For example, cable television has stimulated the growth of cable networks that carry a wider range of programming than otherwise would have been produced. Another example is public broadcasting, which supports programming that would not have been forthcoming under commercial sponsorship.

The Effects of DBS

Widespread subscription to DBS systems would have both positive and negative effects on program diversity. It would favorably affect diversity by facilitating access—the first category above. It would reduce the price of program access to DBS subscribers, as well as to cable subscribers if cable subscription rates fall as a result of competition with DBS. It would also increase the convenience of access by serving households not passed by cable. If DBS provides many more channels than cable, it will further increase convenience of access—depending in part on the fit between the showing of programs and times zones in the CONUS, as noted above. At the same time, widespread use of DBS would reduce "local" diversity by carrying little, if any, locally originated programming.

DBS systems may encourage production of new programs. As noted in Sec. III, with their instantaneous national coverage, DBS systems may stimulate production of programming to small, widely scattered audiences.[14] Moreover, by permitting easier access to HDTV programs in the nascent stage of HDTV commercialization, DBS systems may encourage more production of HDTV programs than otherwise.

However, if markets for new special-interest programming are weak, DBS would probably carry much the same material as that on cable. Indeed, cable networks could be carried by DBS systems in the same way as they are now carried on cable.

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[14]Expanded educational applications are among the possibilities. For example, Advanced Communications Corporation (ACC), one of the grantees listed in Table 4, proposes to dedicate four of its 32 transponders to school and library use (*Communications Daily*, September 14, 1990, pp. 3–4).

Additional program production might also be encouraged because a strong additional multichannel outlet, in addition to cable, would give producers expanded access to the viewing public. Benefiting from expanded competition among channel suppliers, the programmer who fails to sell to one medium may succeed in selling to another.

Additional funding for program production would come from DBS households that otherwise would not subscribe to cable. Running in the other direction, however, are reductions in cable industry revenues, which could adversely affect the amount cable operators spend on programming. If the overall subscriber base expands, along with new pay-per-view options, the total funding for programming will probably increase.

Transparent Access to Signal Inputs

A final point merits emphasis: To promote diversity by facilitating access, viewers should have transparent access to the various inputs into their TV receivers—whether from DBS, over-the-air broadcast, cable, or other systems. For example, as noted above, DBS subscribers would remain dependent on over-the-air reception of local broadcasting stations. With transparent access, selection of a given channel on the TV receiver would automatically switch the receiver to the DBS or broadcast signal input associated with that channel. This feature may be desirable enough to persuade DBS providers to supply this switch and, eventually, new TV receivers may incorporate it. However, if this switching capability is not provided (because the benefits are inadequately reflected in market forces), the FCC should consider mandating its provision in new television sets sold in the United States. This action would be similar to that taken by the FCC in 1962, when it mandated that all residential television receivers sold in the United States be capable of receiving UHF as well as VHF broadcasting signals.[15]

COMMON CARRIER COMPARED WITH PRIVATE CARRIER STATUS

Cable companies, as private carriers, control the programming content of their channels, i.e., they serve as information gatekeepers, and some have financial interests in program production. As discussed above, many have expressed concern about whether this structure

[15]For an analysis of the FCC's all-channel television receiver law, see Webbink (1969).

would permit program suppliers to unduly restrict access to the public, or permit cable operators to deny programs to competing media.

In contrast, under a common carrier approach the carrier function would be separated from content control and program production, with channels offered on a nondiscriminatory basis to all program suppliers. The FCC, Congress, and other groups are asking whether this structure would promote more socially desirable outcomes. The debate has been triggered in part by questions of whether telephone companies should be permitted to compete with cable companies and, if so, whether they should operate only as common carriers.

A similar question arises as to whether DBS operators should be required to operate solely as common carriers. Because DBS systems would provide an alternative to cable, with both possibly competing side by side, the problem posed by the single gatekeeper is less serious than if DBS systems were to become monopoly providers. Wireless cable systems—which bear the closest technological similarities to DBS systems—are permitted to operate either as common carriers or, like cable operators, as noncommon carriers. Most operate as noncommon carriers, at least in part because of the greater freedom they have to negotiate with program suppliers.[16] Similarly, DBS operators will probably prefer not to operate as common carriers. Rather, they will want to package their own programs, with competing systems targeting somewhat different audiences, depending on the market for particular types of programs.

Given legal precedents it would be difficult to require DBS operators to serve purely as common carriers, for the same reasons that it would be difficult to divorce cable operators from any control over program content. On the other hand, the tradition of telephone companies serving as common carriers would make easier the expansion of common carrier status to cover television services supplied by telephone companies.

CABLE FRANCHISE OBLIGATIONS AND RADIO SPECTRUM USE

Local franchise requirements apply to cable television but not to DBS or other wireless technologies.[17] The legal basis for the franchise requirement lies in cable operators' need for access to public rights of

[16]Some wireless cable systems do operate as common carriers, however (see Wireless Cable Association, 1990, p. 119).

[17]The FCC has recently ruled that DBS and other wireless systems are not to be treated, for statutory purposes, as "cable" systems (FCC, 1990e).

way. To compensate for costs imposed on society, cable operators can properly be charged for the inconveniences or "externalities" imposed by trenching through streets and other disruptions.

But franchise agreements probably go beyond compensation for these externalities.[18] Because cable has been widely regarded as a monopoly with the potential to earn large excess profits, municipalities have sought to extract for themselves some of this excess by imposing extensive obligations on cable operators, rather than seeking compensation only for the externalities of cable construction and maintenance. Examples are levies on gross revenues, construction of institutional networks to serve public users, and facilities for local program origination.[19] During the bidding wars of the 1970s and early 1980s, cable operators agreed to heavy obligations in return for potentially lucrative franchises.

Without the need for access through public rights of way, no such justification exists for imposing franchise requirements on DBS operators. At the same time, if DBS becomes a significant competitor to franchised cable systems, the basic assumption behind stringent franchise requirements—that cable systems are able to earn excess profits—would be undercut. Excess profits would tend to disappear in the face of market pressures, but cable franchise obligations would continue unless franchise agreements were modified.[20]

The best solution is to impose requirements on all technologies to reflect costs that otherwise would not be taken into account in the marketplace, so that all technologies bear their entire social costs. These would include (a) a franchise requirement on cable operators limited to the costs imposed on society caused by disruption of public rights of way, and (b) a fee for radio spectrum use by DBS and other users of radio spectrum, to reflect the market value of this scarce resource.

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[18]Unfortunately, we do not have good estimates of the externalities imposed on society by the need for cable operators to have access to public rights-of-way. However, for aerial installation, cable systems share existing poles with telephone companies so that public disruption costs are low. Similarly, underground installation frequently involves the sharing of conduits with telephone companies, reducing disruption costs. These costs are higher when new trenches must be dug for cable.

[19]In 1989 local franchise fees amounted to $767 million, compared to cable industry revenues of $17.7 billion (FCC, 1990b, para. 3).

[20]In principle, the best way for a municipality to extract a portion of excess profits is to tax them. The tax would automatically fall as excess profits decline in response to competitive pressures from DBS or elsewhere. The difficulty is that economic profits are not well measured by accounting profits. Therefore, municipalities resort to easily measured variables such as gross cable revenues as a tax base or specific requirements for public use of cable facilities.

With respect to the first requirement, if the market power of cable systems erodes, municipalities would be under pressure to reduce the franchise obligations of cable systems. Cable operators might seek legislative relief, perhaps through amendments to the Cable Act of 1984. In any event, the debate about franchise obligations will loom prominently if DBS systems emerge as a widespread competitor to cable.

With respect to the second requirement, economists have long sought ways to substitute marketplace pressures for administrative determinations in allocating scarce radio frequency space.[21] In a well-operating market system, DBS and other spectrum users would pay amounts that reflect the "opportunity" costs of spectrum space—the value of the space in its next most valuable use. With a market-dictated allocation, the parties that obtain particular DBS orbital positions would be those willing to pay the highest amounts in an auction, with the proceeds probably going to the public treasury. The bidding might be expanded to include other uses (i.e., voice and data) for these orbital positions. This allocation process would be conducted within constraints imposed by international agreements, and with these agreements themselves being subject to modification over time to reflect pressures arising from market forces. Similar allocative processes might be introduced in the radio frequency bands used for wireless cable and other purposes.

Although a market-based approach would be difficult to introduce, because of institutional inertia and other factors,[22] it should be considered by the FCC in the interest of improving the efficiency of radio spectrum use.

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[21]An extensive survey of the literature, with many cites, is provided by Fountain (1988).

[22]These difficulties are discussed at length in Fountain (1988).

VIII. CONCLUSIONS

If widespread competition to cable emerges from any quarter, it is most likely to come from high-power DBS systems. High-power DBS systems, because of their smaller user antennas, have greater potential than do medium-power DBS systems for widely competing with cable. Medium-power systems, with their lower space segment costs, nevertheless may be profitable by drawing from a smaller subscriber base consisting largely of households not passed by cable.

Compared to second cable operators seeking to compete against incumbent cable networks, a DBS system has potentially lower local market entry and exit costs, once its space segment is operating. This situation would render the threat of entry more credible, inducing cable operators to lower prices and improve service even in areas where no households subscribe to DBS service. The potential for DBS inroads is greater in areas where (a) low population density increases the cost of cabling, (b) cable networks have low subscriber penetration, and (c) cable networks are of low-capacity, obsolete design.

Other alternatives to cable are less promising as widespread competitors to cable. Wireless cable suffers from severe line-of-sight restrictions and capacity limitations. SMATV systems are limited to compact clusters of dwellings. The large, expensive C-band HSD terminals have limited appeal, especially if small, low-cost, DBS alternatives with attractive programming emerge.

On the basis of our model high-power DBS system, outcomes are rather insensitive to the cost of the space segment for as few as three or four million subscribers nationwide. Of greater importance are the cost of user terminals and operating expenses. If per-subscriber operating expenses and service offerings were the same for the two media, small-antenna DBS systems would be widely competitive with modern, high-capacity cable systems only if the cost of user terminals were in the neighborhood of $300 to $500. However, operating expenses of DBS systems, relative to cable, involve uncertainties because the technologies differ in many ways. Differences in these expenses for the two media could greatly affect their competitive positions.

Service offerings may also vary, affecting the relative competitive positions of cable and DBS systems. By providing instantaneous national coverage, DBS systems will strengthen the incentives to produce new programs designed for widely scattered audiences such as

schools and other niche markets. Moreover, DBS is the most promising medium for introducing nationwide broadcasting of HDTV.

Digital video compression will play an important role in the future of DBS. Several approaches exist to compressing digital video signals and new ones may be discovered. It remains to be seen which ones turn out to be most attractive in terms of cost, time to implement, and degree of compression attainable with acceptable quality.

Digital video compression can also be used in terrestrial systems. However, our research suggests that DBS systems, in comparison with wireless cable systems, would differentially benefit from the use of digital video compression. Within the constraints of practical modulation schemes, the channel multiplication ratio made possible by a given degree of digital compression in a 24 MHz DBS channel is about twice that available in a 6 MHz terrestrial channel.

Although the pace of technological advance is uncertain, advances are likely to occur especially rapidly in microelectronics, as has been true in the past. This process will differentially benefit DBS systems, especially digital ones, because of their heavier reliance than cable on electronics components. If so, DBS systems will become progressively more attractive, relative to cable, over time.

However, we cannot conclude from this study alone whether DBS *will* offer widespread competition to cable during the 1990s. Outcomes will depend on several interrelated economic and technical factors.

- *The cost of earth terminals with satisfactory performance.* Especially important is the cost of incorporating digital video compression.
- *The tradeoff between antenna size and consumer acceptance.* The smaller the antenna size, the smaller the aesthetic handicap—as well as manufacturing and other costs.
- *The degree to which video compression reduces the per-channel cost of the space segment.* For a given number of channels offered to subscribers, video compression would permit use of fewer transponders (and satellites), thereby reducing up-front investment and risk. Alternatively, for a given number of transponders, video compression would permit a larger number of channels.
- *The level of operating expenses including program acquisition costs.* The costs of program acquisition depend on whether DBS systems will have access to programs under the same terms and conditions available to cable operators. Equality of access will depend, in part, on whether DBS systems can ensure signal security on a parity with cable operators. It is easier to

design a more secure encryption algorithm for a digital-based DBS system than for an analog-based cable system, but the consequences of a breakdown in signal security are more serious for a DBS system. On balance, whether a DBS system will be more or less secure than a cable system remains uncertain.

- *The degree to which demands exist for channel capacity and services beyond those offered by cable systems.* Critical are (a) the amounts subscribers and advertisers are willing to pay for the additional programming (which will presumably cater to highly specialized tastes), and (b) the costs of acquiring the programming, marketing it to subscribers, and transmitting it from the point of origination to subscriber terminals.
- *The extent to which DBS systems would be handicapped by carrying few, if any, signals of local broadcasting stations.* The handicap depends on (a) the quality of over-the-air reception, which varies among geographical areas, and (b) the value that households place on locally originated programs, such as local news and sports.

Moreover, two conclusions of the study involve public policy issues whose resolution could significantly affect the future of DBS systems.

- The premiums for programs reportedly now paid by media that compete with cable would pose a significant burden for DBS systems. Whether program access is being used as an anticompetitive tool to hamper the growth of DBS is an important area for government investigation.
- Cable operators are likely to face heavy risks if they buy into DBS systems to foreclose competition with their cable systems. Nevertheless, crossownership is an important issue for investigation by the FCC, Congress, and the Department of Justice.

Finally, the study reaches four other conclusions, relating to public policy, which would be relevant if widespread DBS growth *does* occur.

- Local commercial and local public broadcasting could be detrimentally affected, running contrary to the longstanding goal, pursued by the FCC, of promoting "localism" in broadcasting.
- DBS systems will improve program diversity if they expand viewers' access to existing programs and stimulate the production of additional ones—contributing to First Amendment goals.
- If competition between DBS and other media leaves DBS without monopoly power, the issue of common carrier versus

private carrier status for DBS would be of less concern than otherwise. Moreover, its functional similarity to other wireless systems and to cable systems would argue in favor of private carrier status.

- Local franchise requirements for cable might need to be modified, and consideration should be given to establishing a market for radio spectrum use, to help ensure that competitive outcomes are economically efficient.

Appendix

DIGITIZING A VIDEO SIGNAL

In Sec. VI, we calculated the amount of digital video compression that might be feasible for our model high-power DBS system. This analysis rested on the assumption that a bit rate of 76 Mbps is necessary to transmit an uncompressed, digitized video NTSC signal. The justification for this bit rate is given below.

To compress a video signal, it must first be converted from an analog to a digital signal—i.e., a stream of bits. If the digitized signal were not then compressed in some manner, it would require a larger bandwidth to transmit than would the original analog signal. For this reason digitized video heretofore has not generally been used.

An NTSC signal has 525 scanning (i.e., horizontal) lines, about 480 of which are active, for each frame. The aspect ratio (width to height) of an NTSC signal is 4:3, which gives 480 (4/3) = 640 pixels (which are picture elements or little squares) in the horizontal direction. For broadcast television, the horizontal resolution of the television sets is less, "stretching" the pixels in the horizontal direction so that, instead of 640 pixels on each horizontal line, there are 440.

The total number of pixels per frame therefore can be calculated as

480 lines/frame × 440 pixels/line = 211,200 pixels per frame.

At 30 frames per second, this amounts to a pixel transmission rate of 6,336,000 pixels per second.

Each pixel's intensity level is quantized using eight bits, giving 2^8 = 256 possible levels of intensity for each pixel. This intensity level must be transmitted for each of three colors for the RGB (red, green, blue) system. Therefore, to transmit broadcast digitized NTSC using an RGB format, the data rate would be

211,200 pixels/frame × 30 frames/sec × 8 bits/pixels/color × 3 colors
= 152,064,000 bit/sec
= 152 Mbps.

The data rate shown can be halved by making use of the fact that the human eye does not have as much spatial acuity (the ability to discern sharp edges) for colors as it does for luminance (black-and-white intensity). First, color is transmitted not as an RGB signal but rather as luminance and two color *differences* (these differences are chosen so

as to allow all three colors to be reconstructed) in what is known as the YUV system. Second, in the YUV system bigger pixels are used for color—pixels that are twice as wide and twice as high, *so only a fourth as many pixels are needed to send each color difference signal (U,V) as are needed for the luminance signal (Y).* A comparison between the equivalent bits per pixel needed for the two systems reveals that:

For RGB, 8 + 8 + 8 = 24 bits/pixel
For YUV, 8 + 8/4 + 8/4 = 12 bits/pixel.

(A similar system is also used to minimize the bandwidth needed to transmit analog color NTSC. In the analog case the color is transmitted on a subcarrier.) Therefore, using YUV in a digital NTSC transmission, the data rate is halved:

Bit rate required to transmit broadcast digitized NTSC
= (152,064,000/2) bps
= 76 Mbps.

Suppose we wanted to make a straightforward calculation of the number of equivalent pixels needed in the horizontal direction, given that each frame has about 480 active lines. We would use the fact that a television set has an aspect ratio of 4:3 and calculate the number of equivalent pixels in each horizontal line as 480 (4/3) = 640. This is known as the VGA NTSC standard. (The filters in television sets do not have enough bandwidth to accommodate the VGA standard.)

Bit rate required to transmit VGA digitized NTSC
= (640/440)(76,032,000 bits/sec)
= 110.6 Mbps.

The CCIR standard for studio-quality NTSC specifies an equivalent of 720 pixels for Y and 360 pixels each for U and V in each horizontal line:

Bit rate required to transmit 601–1 (studio quality) digitized NTSC
= [(720 pixels/line) + 2(360 pixels/line)]
(480 lines)(30 frames/sec)
= 166 Mbps.

Finally, making some assumptions regarding HDTV format:

Bit rate required to transmit digitized HDTV (SMPTE 240M)
= (1920 pixels/line)(1035 active lines)
(12 bits/pixel)(30 frames/sec)
= 716 Mbps.

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